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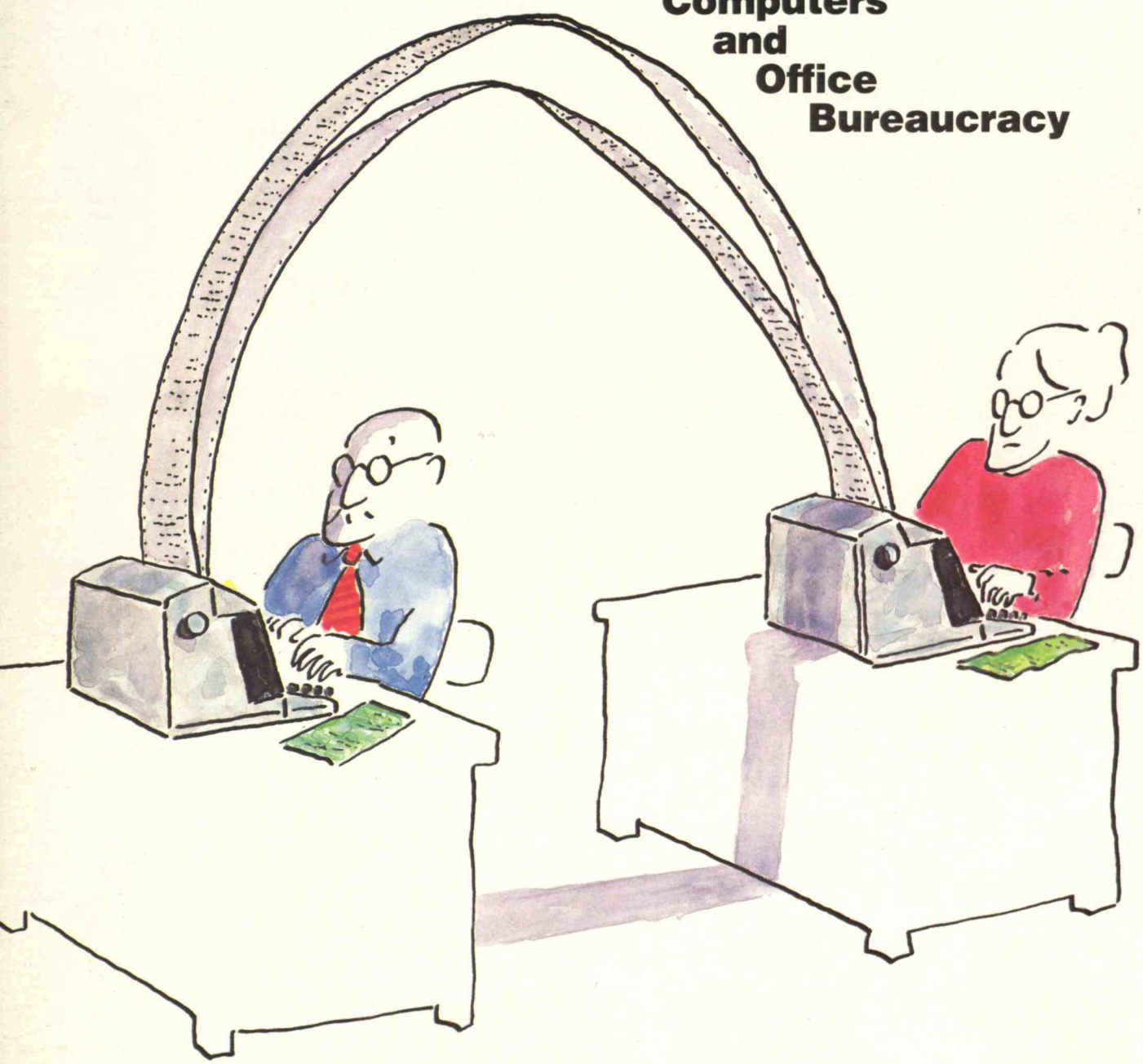

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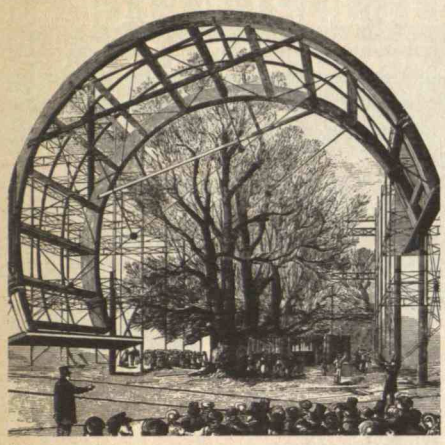

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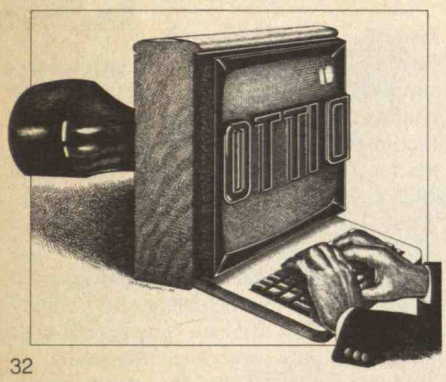

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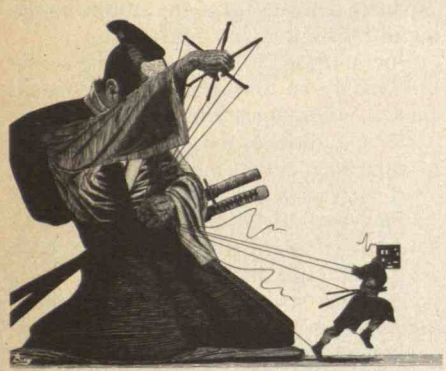

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LETTERS

Play Ball

In "How Engineering Is Like Baseball" (*January, page 8*), an engineering student asks, "What should I do if I am assigned work that is not in the best interests of society?" Samuel Florman's advice is for the student "to embark upon his career with great enthusiasm and not to be overly apprehensive about his work's harming society." Mr. Florman urges the student to develop a sense of loyalty to profession and employer, and to trust that "if, in spite of the enormous odds against it, he does encounter base practices," professional enthusiasm and loyalty will lead him to do the ethically right thing.

But this advice suggests a weak and inappropriate role for ethics in professional practice. The student's concerns are more likely to be aggravated than helped by Mr. Florman's advice, since he implies that the concerns are somehow misplaced and inappropriate. I believe the student is really asking, "How can I pursue my career with the confidence that I will recognize work that is not in the best interest of society when confronted by it?"

Enthusiasm and loyalty, desirable elements in any profession, neither guarantee nor replace ethical integrity. To suggest that they do diverts us from the ongoing attention required to maintain ethical professional practices.

Scott Cook
Cambridge, Mass.

Mr. Florman responds:
The answer to the student's question is not very simple; when engineers are assigned work that is not in the best interests of society, they cannot simply avoid doing it. I agree that people should not do what their conscience tells them not to. But I cannot accept the idea that each engineer should be free to decide what is best for society. Our democratic society has established procedures, imperfect as they may be, for making and changing policy. Good sentiments, like national anthems, have their place but do not solve our problems.

Strike One

Powerful nations usually manage to fight each other on the territory of hapless third parties ("*Managing the Enterprise in Space*" *by Harvey Brooks, April, page 38*). Although the sea and air have no inhabitants, the effects of nuclear conflicts in those battlegrounds would be felt on every land mass. This leaves space—the farther out the better—as the last battleground.

Humans have the dubious distinction of having used every weapon they have ever developed. I sorely hope we never unleash a nuclear holocaust, but our species' history suggests we will. Better to irradiate cubic miles of vacuum than our homes and children. Besides, the fireworks display might shock some sense into the belligerents with little or no loss of life.

Jerry R. Horton
Wellesley, Mass.

Professor Brooks responds:
Neither historical analogy nor speculation supports the optimistic assumption that conflict in space is an alternative to conflict in traditional battlefields. Naval battles have often been a prelude to invasion and destruction of the territory of the loser, and that has been even more true of battles for air superiority. Hitler's destruction of the Polish air force in 1939 paved the way for the defeat and devastation of Poland. U.S. air superiority over Japanese cities and the impotence of Japanese defenses led to the atomic bombing of Hiroshima and Nagasaki.

One purpose of space battles would presumably be to destroy the command, control, communications, and intelligence (C^3I) capabilities of the other side, leading to surrender before Armageddon. However, increasing the vulnerability of C^3I systems would tend to encourage various kinds of "hair-trigger" postures on both sides and the incentives for making preemptive strikes. Any developments that make C^3I systems more vulnerable are inherently destabilizing and increase the probability of general nuclear war.

Oil and Waters

Any employee of a major oil company involved with offshore oil exploration will strongly resent Robert W. Howarth's notion that "our rush to develop offshore oil typifies our sometimes reckless attitude" toward pollution of natural resources ("*Debunking the Myth of the 'Inexhaustible' Ocean,*" *November/December, page 85*). Oil companies go to great lengths and expense to insure that such development does not threaten the environment. Fur-

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thermore, the federal government makes certain that oil companies obey strict environmental regulations through the Minerals Management Service. Accidents such as the spill in the Santa Barbara channel and the more recent Pemex spill in the Gulf of Mexico are extremely rare. New technology for recovering offshore oil will not spring spontaneously from an engineer's drawing board. Rather, such technology stems from a constant evolution of existing techniques.
Vincent E. Stroud
Morgan City, La.

Mr. Stroud is a civil engineer at Mobil Oil.

Dr. Howarth replies:
Large accidents from offshore oil development are rare. But despite the best intentions of industry and strict supervision by the Minerals Management Service, spills do occur, threatening natural resources. The government is now expanding its offshore leasing program to unprecedented levels, attempting to lease almost 100 times more area in the next five years than it leased during the previous 40 years. Thus, the probability of accidents will be greater.

But the major threat posed by offshore oil drilling may not come from large accidents but rather from the routine, chronic discharge of oil near wells. Government regulation allows such discharges, and the total amount of oil released can be quite large. Recent studies in the North Sea clearly show that oil has contaminated water and sediments near rigs. One study even suggests that much of the North Sea is contaminated with oil. Such studies are few and their implications are poorly understood. Expanding offshore oil development in U.S. waters a hundredfold before gaining a better understanding of the chronic effects is, I believe, reckless.

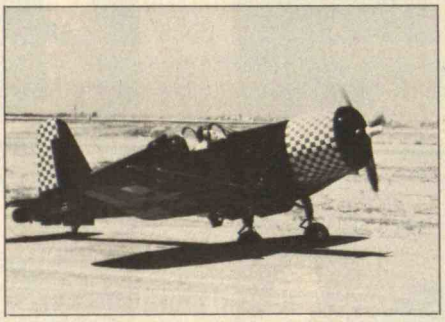
Professionals versus the People

In "Managing Nuclear Wastes: Let the Public Speak" (*October, page 12*), Edward J. Woodhouse points out that the public is ill-informed on nuclear issues, yet recommends that "the people decide." Why bother educating professionals in special fields if their knowledge and recommendations will not be accepted? As technology becomes more complex, can "the people" be expected to make intelligent decisions on highly technical matters? How many people know that the earth and its waters have always been polluted with trillions of tons of radioactive materials and that 11 of the 92 chemical elements that compose the earth are radioactive?
Frank Costagliola
Alexandria, Va.

It's a Plane

Perhaps it was intended as an April Fools' joke, but you didn't fool me. The airplane on page 30 of "The Sky's the Limit" by Elaine de Man (*April, picture 4*) is not a Corsair but a P-51 Mustang.
Bob Lockerby
Portland, Ore.

There must be more to a homebuilt aircraft than the article suggests. When the builders of the "Corsair" finished their project, it ended up looking like a P-51 Mustang.
Thomas D. Laase
Pueblo, Colo.



Countless sharp-eyed observers noticed that the "Corsair" pictured in the article was indeed a P-51 Mustang, also a warbird. This homebuilt Corsair is scaled down in size from the original airplane.

From All Walks

The original design for the Kansas City Hyatt Regency would probably have worked if architects had provided sufficient detail on how to assemble the parts of the walkway (*"When Cracks Become Breakthroughs" by Henry Petroski, August/September, page 18*). The rods holding up the walkway should have been made in two parts and joined by a connecting nut (*"Nuts and Bolts," letter from Kenneth Green, November/December, page 4*). One can readily assemble those parts using wrenches. Neither the construction crew nor the design reviewers could have built the structure properly without such details.
Robert Kocsis
Wilmington, Del.

I wonder if any of the Hyatt's architects ever heard of the thread connector used in the plumbing trade. This connector, or nut, is a short pipe with continuous internal threads. Two rods with external threads at the ends can be joined by this connector to create a continuous rod, with the nut supporting the beam. Any engineering freshman can consult *Marks' Standard Handbook for Mechanical Engineers* for the number of threads required to exceed the tensile strength of the rod.
John E. Clemens
Xenia, Ohio

Rods with threaded ends have long been used as tension rods in aircraft and bridges such as the Brooklyn Bridge. Their use would not have added significantly to the cost of the Kansas City project.
Harold Strauss
Santa Monica, Calif.

The walkway support could have been fabricated as designed with either a welded collar or a pump-rod connector. The change would have worked with a large washer such as those used in timber construction.
Kenneth Turner
Sacramento, Calif.

Mr. Petroski responds:
The readers' solution of using a "split-nut" connector, known as a "sleeve nut" in the construction industry, in the walkway rods was also offered by observers in other postaccident discussions. Indeed, a threaded connector would have obviated the fatal design change that doubled the stress on the box beam.

But the problem remains: How do we eliminate all situations that can lead to seemingly innocuous ad hoc modifications? Even if all proposed designs were published, it is unlikely that every design fault would be caught. Design flaws are simply part of the risk of living in a dynamic society with evolving technologies.

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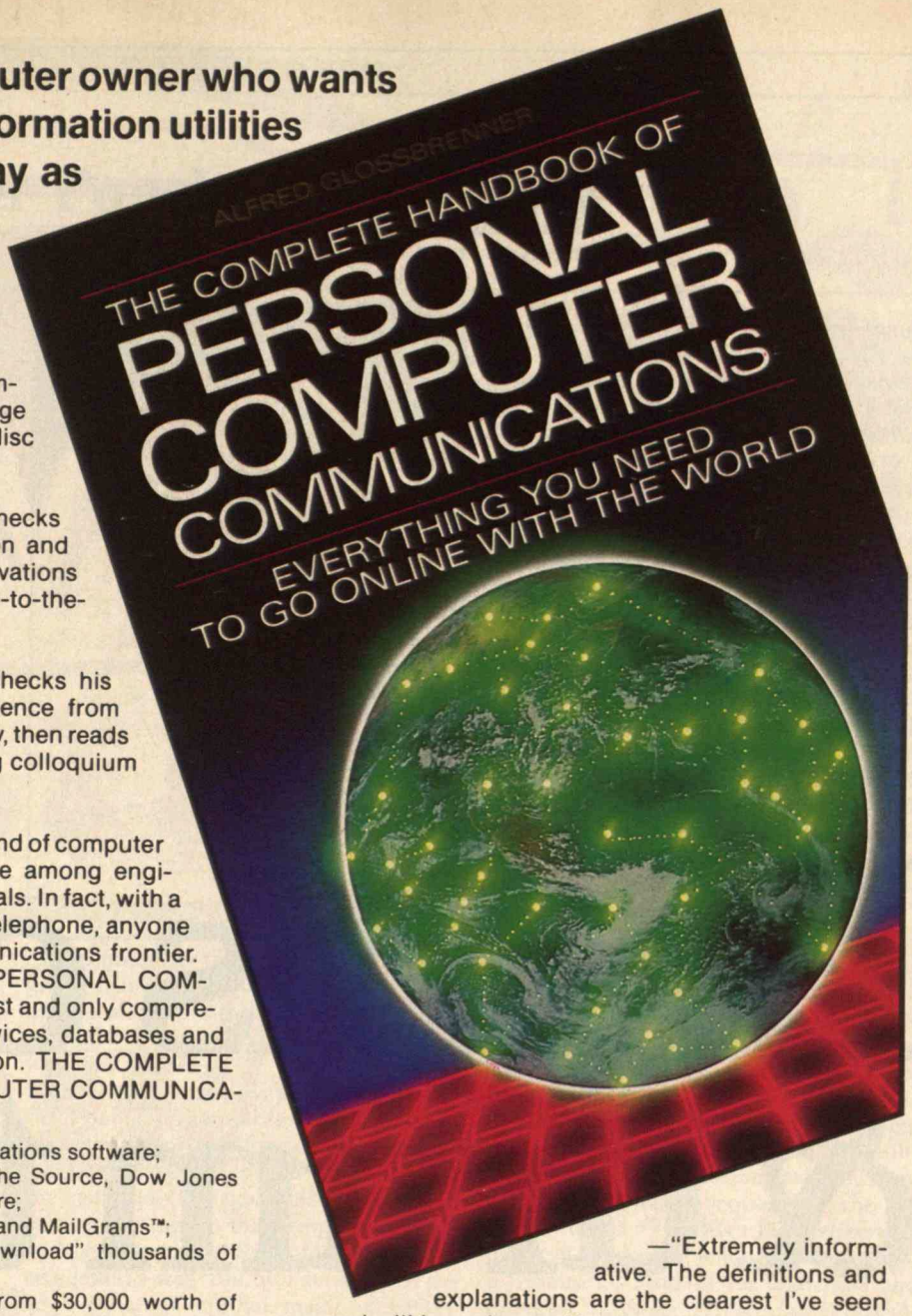

*A consulting engineer orders a computer search of recent articles on bridge construction, then stores the data on disc for future use;

*An executive on a business trip checks weather conditions at her destination and last night's sports scores, makes reservations for her return flight, and obtains up-to-the-minute quotes on her stock portfolio;

*A pilot whose hobby is avionics checks his "electronic mailbox" for correspondence from other avionics buffs around the country, then reads the latest contributions to an ongoing colloquium on proposed FAA regulations.

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When most people think of oil, they usually think of either Arabs or Texans. Well, now they can also think of West Africans. Nearly a dozen West African countries have developed oil and gas resources and further exploration continues at an accelerated pace.

Mention Africa and some people get an idea of mud huts and watering holes. Well, be assured that some of the finest hotels in the world are located in West Africa. Air-conditioned rooms, swimming pools, friendly bars and fine restaurants. It's just like home... only better.

Drum talk—or "bush telegraph" as it is commonly called—is really a secret language that only the initiated listener can understand. Wanna learn?

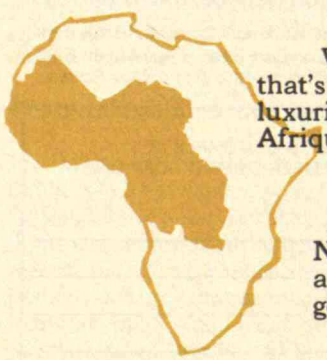
Abidjan, Ivory Coast is often referred to as the "Manhattan of Africa". It has a "Central Park", skyscrapers, and the Hotel Ivoire is often compared to a glass-enclosed Rockefeller Center.

Bargain for a beautiful Dan mask in the morning and enjoy a delicious martini in the evening. The excitement, beauty and sophistication of West Africa are waiting for you.

Drums of oil & drum talk.

Much of the great African art comes from West Africa, and the best way to get to and around West Africa is to fly Air Afrique. We have the most complete schedule of interconnecting flights between West African cities, New York, Europe and the rest of Africa. So if you're flying to Africa, fly us (you'll like us).

Some West African countries are extremely rich in natural resources. For example, Gabon has huge deposits of oil, uranium, manganese and iron.



West Africa is that portion of Africa that's closest to the U.S.A. It's just seven luxurious hours away when you fly Air Afrique. Africa begins with Air Afrique.

Now what are you waiting for? Isn't it time you discovered West Africa? Just call your Travel Agent or your nearest Air Afrique/Air France office today. Hurry!

The African mask is not a disguise. Nor is the wearer a man pretending to be a god. Rather, mask and man become a god who is visible in its real form.

Handshaking is an important social grace in West Africa, so remember to shake hands with everyone in the room when you're being introduced. Also, always shake hands (pass food or gifts, etc.) with your right hand. That's important.

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Africa begins with Air Afrique.
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West Africa.

Another Punch at Publicity Puff

IN the February/March issue, I criticized needless hype in the public announcement of two laboratory developments in solar-powered electrolysis of water, which produces hydrogen for fuel. My comments sparked some interesting letters, including one from a scientist directly involved. These responses drive home the point that overselling research for the sake of publicity is counterproductive.

To recapitulate, I referred to announcements last fall from the University of California at Berkeley and Texas A&M University. At the Lawrence Berkeley Laboratory, researchers suggested it might be possible to extract hydrogen from water using solar energy and cheap electrodes, dispensing with the need for expensive catalysts such as platinum. At Texas A&M, researchers in the laboratory of John Bockris had powered a hydrogen-producing cell with a sun-simulating lamp that used inexpensive silicon electrodes.

The results were respectively a "significant experiment" and a "notable laboratory achievement," but the public wasn't allowed to take them on their merits. Both accomplishments were presented to the press in such a hucksterish manner as to lead to reports of major breakthroughs, with the hydrogen economy coming in about a decade. There was even talk of obtaining hydrogen fuel equivalent in cost to $1-a-gallon gasoline. The Texas announcement seemed a kind of "me too" response to the Berkeley publicity and it all provoked considerable criticism from the scientific community.

When excesses like this occur in announcing legitimate research news, publicity pressures external to the laboratory often are involved, as Bockris writes to explain. After agreeing that "no hype is the best way," he goes on to say, "Personally, I learned this from the results of responding to requests from my university's media department for research news." He adds, "Professors who work in subjects of immediate public interest, such as the production of pollution-free fuel,

ROBERT C. COWEN is science editor of the *Christian Science Monitor* and former president of the National Association of Science Writers.

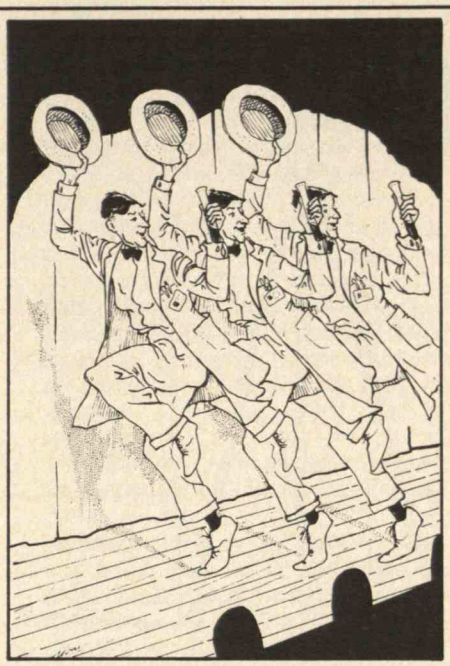


ILLUSTRATION: DENNIS MOORE

experience many pressures. If one research group trumpets its progress, the reaction among workers in other groups is understandable: 'Why don't you tell them about what we've done?' "

University administrators and their official publicists should help scientists find the right perspective for announcing their work to the press. But in the drive to boost the institution's image, which affects fund raising, I suspect that responsibility is widely forgotten. After I received Bockris's letter, I was told by a member of the news office of another major university that he was feeling considerable pressure from his administration to publicize research work.

Bockris aptly points out the danger of such pressure: "As scientists depend for their monetary support on a reputation for integrity, any scientist who 'leads reporters down the garden path' would himself be walking the plank. What gain would accrue from conscious exaggeration?"

Bockris describes yet another trap: "The difficulty is that for some of the media, everything tends to be wonderfully good or appallingly bad. When things are just very good, with a lot of grayness in the future, it isn't newsworthy. Hence, when one does say something about what one is doing, what comes out in the press is sometimes analogous to Beethoven played in rock."

Amen! But institutional news offices should help scientists avoid saying things that reporters might unintentionally or even intentionally distort. They shouldn't transmit institutional pressures to scientists, who then make rash statements that the press is bound to run away with.

Scientists may indeed be discouraged to see other research groups getting excessive publicity when their own work attracts less attention. For example, G.A. Crawford, director of marketing for Electrolyser, Inc. in Toronto, says that his company made "a solid technical achievement with immediate commercial potential" in electrolytic technology. Dozens of reporters were invited to an official plant opening a year ago and many press kits given out. Yet Dr. Crawford laments that the event "did not generate nearly the excitement in the press that the less significant developments at Berkeley and Texas did." He asks, "Could it be that we presented it with too little hype?"

He adds, "As usual, the issue resolves itself into a question of moderation and appropriateness. It is not a matter of all hype or no hype but rather the right hype to generate the exposure and response justified by the issue—not an easy compromise."

More is at stake than a few misleading news stories or the reputations of individual scientists, important as these may be. Overpromotion jeopardizes the research itself if a disgusted, turned-off public is no longer willing to support it. F.J. Salzano, head of the Materials and Energy Conversion Division at Brookhaven National Laboratory, and his colleague A. Mezzina, program manager for Brookhaven's Chemical/Hydrogen Energy Systems Program, reinforce this. They write that "in the case of hydrogen technology, the level of support should be analogous to insurance premiums one pays to avoid potential catastrophe in the future. . . . The 'hype' runs the risk of causing total abandonment of a technological hedge on future energy uncertainties."

This is indeed the larger danger I had in mind, although I didn't spell it out as clearly as Salzano and Mezzina. As a science writer, I wouldn't want to stem the flow of sound, exciting science and engineering news from universities and other research institutions. But needless exaggeration for publicity's sake does no one—not even the reporter in search of page-one stories—any good. □

A United Voice for Engineers

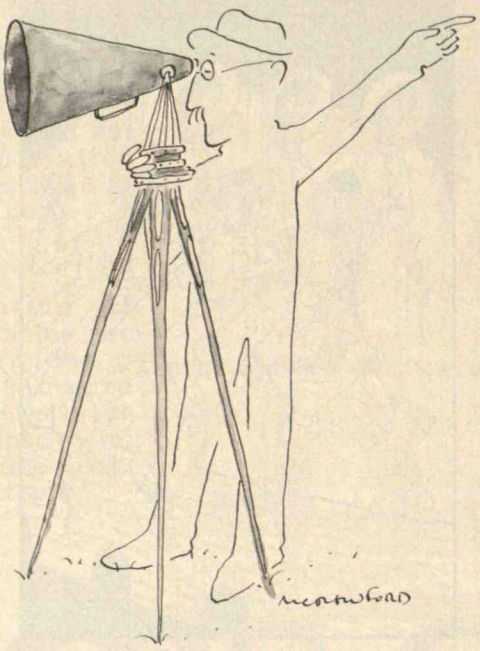
IN May last year I traveled to Port St. Lucie, Fla., for a conference sponsored by the American Association of Engineering Societies (AAES). That umbrella organization, a federation of more than 40 engineering societies, was in its third year of existence and seemed to be flourishing. The conference was called "A Turning Point," and the program notes spoke glowingly of "turning to engineering unity as an effective means to achieve common goals."

Little did I know that while speakers addressed such lofty topics as education and productivity, behind-the-scenes debates were threatening the group solidarity that had so recently been achieved. Leaders of the National Society of Professional Engineers (NSPE), one of the member societies, were closeted with representatives of AAES trying to resolve disputes, particularly regarding an engineering presence in Washington, D.C. The NSPE, founded in 1934, considers representing engineers one of its primary functions and has long had an active office in the nation's capitol. Its leaders were alarmed by the prospect that the AAES would duplicate these activities and possibly even set up a Washington office as a satellite to its headquarters in New York.

By conference end, verbal agreements had been reached. NSPE would represent AAES in Washington, with details of the arrangement to be worked out by staff personnel. Before the month was over, however, these understandings had again become misunderstandings, and NSPE announced that it was withdrawing from AAES.

Word came of disaffections by other AAES members throughout the summer and fall of 1982, until at year's end more than a dozen societies—mostly smaller ones—had announced their intention to withdraw. I read of these developments first with surprise and then with dismay. If engineers cannot master the basics of democratic cooperation, what hope can there be for American society as a whole?

SAMUEL C. FLORMAN, a civil engineer, is author of *Engineering and the Liberal Arts, The Existential Pleasures of Engineering,* and *Blaming Technology.* Late last year Mr. Florman was honored by the American Society of Mechanical Engineers with its Ralph Coats Roe Medal.



Past Divisions

Of course, if I had thought of the matter in historical context, I might have anticipated the disintegration that was taking place. Since the founding of the American Society of Civil Engineers (ASCE) in 1852, the engineering profession has organized mainly along technical specialties. All efforts at profession-wide federation have ended in failure.

The first significant cooperative venture was the Engineering Council, established at the beginning of World War I by four "founder societies"—ASCE, AIME (mining), ASME (mechanical), and IEEE (electrical). (The American Institute of Chemical Engineers, AIChE, was named a fifth "founder" in later years.) Throughout the war the Engineering Council worked successfully with the federal government on many technical matters, and this experience led in 1920 to the formation of the Federated American Engineering Societies (FAES).

Great hopes attended the launching of this enterprise, but the FAES encountered difficulties from the start. A referendum among civil engineers indicated that 60 percent were against affiliation, so ASCE did not formally join until 1928. By then the organization had been dissolved and reconstituted as the American Engineering Council (AEC) following an uproar over two FAES committee reports. One report blamed factory inefficiency on the shortcomings of corporate management, and the other suggested that industry consider switching from a 12-hour work day to an 8-hour day. Commonplace as these ideas may seem today, they incensed many conservative engineering leaders and prompted the AIME to resign in protest.

With its name changed and all the major societies finally on board, AEC operated with some vigor for several years. However, in 1934 deep cuts in its budget forced severe reduction of staff and programs. Thus, AEC's decline and eventual demise are usually blamed on the Great Depression, but growing apathy and controversy were also contributing factors. In spite of last-minute efforts at resuscitation, AEC was dissolved on January 1, 1941.

Shortly thereafter, a Joint Conference Committee was established to provide intersociety liaison, and in 1945 this venture evolved into the Engineers Joint Council (EJC). In the 1950s, EJC began to take shape as a profession-wide unity organization, but again the ecumenical dream was thwarted. For one thing, the National Society of Professional Engineers (NSPE), which also fancied itself as representative of the profession, refused to join. Also, several of the member organizations became nervous about affiliating too closely, fearing they would lose tax exemptions because of EJC's lobbying activities. Finally, in the mid-1960s, a reorganization intended to strengthen the council led instead to its near collapse. The crisis arose when leadership passed to several strong-minded engineers who were well-regarded in industry but had little following in the constituent societies. In spite of attempts to heal the schism, in 1968 three societies withdrew, including IEEE, by far the largest.

While EJC faltered, the societies developed other associations that featured voluntary participation. An informed assembly of society officers met quarterly, sponsored yearly forums, and undertook programs of mutual interest. Although

While EJC faltered, the societies developed other associations that featured voluntary participation. An informal assembly of society officers met quarterly, sponsored yearly forums, and undertook programs of mutual interest. Although this system worked after a fashion, it ob-

ILLUSTRATIONS: MICHAEL CRAWFORD

viously did not satisfy those who sought a strong, structured, central body. Inevitably the call to unity was heard again, and in 1977 discussions began that culminated in the establishment of the now-beleaguered AAES.

In spite of their inability to form a lasting umbrella organization, engineers can point to many significant profession-wide accomplishments. These include operation of the Engineering Societies Library, construction of the United Engineering Center, and establishment of the Engineers' Council for Professional Development, which oversees engineering education and accreditation. Engineers have also worked cooperatively in setting standards and indexing information. But the goal of true professional unity has remained elusive.

Sharing the Umbrella

Although the prospects for AAES are not bright, the cause is not lost. The resignations of the disenchanted member societies do not take effect until the end of this year, and efforts at conciliation have been made. The dispute about Washington representation appeared to be resolved in January when the societies agreed that NSPE would serve as "the principal coordinator for the representation of AAES in Washington" on a year-to-year basis. But attempts to put this understanding into effect have not been without friction, and other grievances from the member societies have yet to be addressed. These relate mainly to the size of the AAES budget and the level of dues.

Some engineers also feel that AAES has assumed too dominant a stance vis-a-vis its member organizations, and that paid staff officials have been given too much power in comparison to elected volunteer officers. In other words, a battle is being waged between those who want a trimmed-down, somewhat loose federation and those who want a strong central organization well financed and amply staffed. This debate is not exactly new to human affairs, and one would have thought that the details would have been thrashed out during the two years of talks that preceded incorporation and adoption of the bylaws.

Be that as it may, if AAES is not to suffer the ignominious fate of its predecessors, both sides will have to yield. The *Continued on next page*

The Politics of Apathy

BY STEVEN L. SOLNICK

WHY *are* engineers, as a group, so apolitical and seemingly divisive?

Much of the blame can be levied against the loosely organized structure of the profession itself. Engineers work in numerous industries as well as private consulting practice, government, and academe. Some are practicing engineers while others have moved on to policy or management tasks. There is no common denominator among many engineers. A professor of electrical engineering, for instance, has little in common with a municipal sanitary engineer.

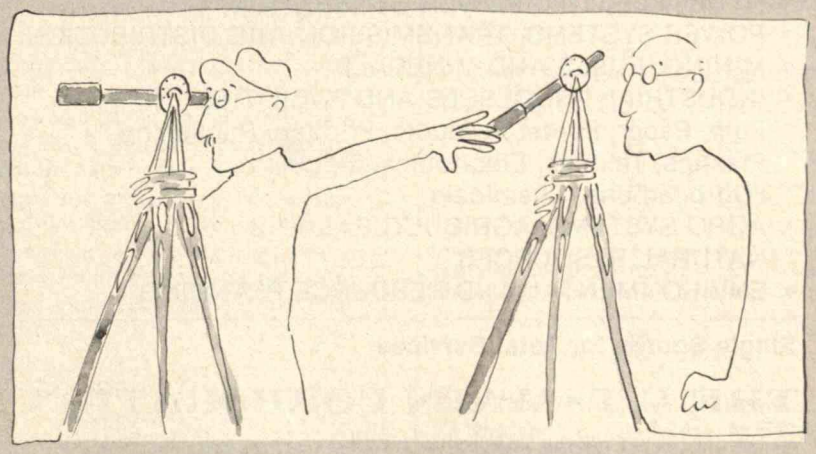
Furthermore, most engineers seem to identify more with their particular industry or discipline than with other engineers. Thus, while civil engineers may know a few other civil engineers doing similar work, they know very little about the work of leading mechanical or chemical engineers. This lack of a "grapevine" hampers any effort to single out engineers prominent in research or policymaking positions. To make matters worse, few engineers publish even in specialized technical journals. Their products are not theories but rather designs for industrial clients, and the proprietary concerns of those clients frequently preclude publication.

Another problem is that many engineers believe that the prestige of their professional societies would be threatened by overt political activity. They fear that engineering societies will be regarded as expert bodies only as long as they don't appear to compromise their objectivity. There are also some serious ethical problems. Many engineers have contracts with governmental agencies and are sensitive about being identified with political controversies.

Industrial loyalty is a final constraint on the political activities of many engineers. They are traditionally identified with management, and most are reluctant to undertake activities antagonistic toward their employers. Because engineers are not unionized, individual nonconformist actions such as whistle-blowing can be quite hazardous.

For all these reasons, many engineers are reluctant to work on political campaigns, contribute to election funds, or even actively endorse candidates. The membership of the Institute of Electrical and Electronic Engineers (IEEE), which has the second largest engineering operation in Washington, has defeated three attempts since 1977 to establish a political action committee (PAC) despite the urgings of its staff. The IEEE staff may try again this year, but few are banking on its success.

Perhaps even more serious than the opposition to political advocacy is the outright ignorance of many engineers about the groups that purport to represent them. The Washington office of the American Society of Mechanical Engineers (ASME) was established in 1972, yet according to staffer Henry Ebert, a resolution appeared on the agenda of ASME's 1981 national meeting calling for the establishment of a *Continued on p. 11*



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founders of AAES, according to a past chairman, "wanted a powerful organization so that AAES could be on a par with organizations as influential as the American Medical Association." Clearly, these founders will have to settle for less, at least for a while. Engineers, unlike doctors, are splintered into a multitude of organizations, each with its venerable traditions that cannot be ignored. On the other hand, the dissident societies must be willing to compromise for the sake of the unity that most engineers consider highly desirable.

In a time of increasingly complex technology and proliferating laws and regulations, the need for an umbrella organization is greater than ever. The advantages of unifying for efficiency, economy, and effectiveness seem manifest. Everywhere people with common interests are pooling their resources, and it is incongruous that engineers, apostles of efficiency, should find it so difficult to follow suit. This is particularly frustrating in view of the fact that a vigorous AAES will enhance the welfare of individual engineers while also serving the needs of the nation.

We live in an age of special-interest groups, in which a selfish factionalism is eroding the great traditions of commonwealth. In one sense, the engineering-unity movement reflects this trend. Clearly engineers hope that a strong central voice will bring them personal advantages on bread and butter matters such as professional liability, pensions, taxes, patents, and immigration. But in a more important sense, a cohesive engineering profession will mean new opportunities for service to the entire community.

The national welfare depends on a renaissance in technical education, innovation, and industrial productivity, as well as sensible policies in the fields of energy, material resources, and environmental protection. The AAES proposes to assist in these areas by counseling government, interacting with industry, and educating the public. It will sponsor conferences, issue publications, and provide expert testimony wherever technical matters are discussed. It will lobby—discretely to be sure—but with the considerable influence that only a nationwide professional group can muster.

Of course, engineers are divided on many issues—particularly those that separate employers from employees—and hostilities often run deep. The strong personalities involved make the task all the more daunting, and this has been true throughout the sad history of attempts at engineering unity. The very singlemindedness and devotion to principle that make one a leader in engineering reduce one's aptitude for political give and take.

Yet tenacity need not mean intransigence. In politics—and that, in its highest sense, is what we are discussing—one must be willing to compromise or even to lose and play the role of loyal opposition. Let there be disputes, of course, but not obstinacy and perpetual threats of secession. (As a dues-paying member of several societies on both sides of the divide, I feel entitled to speak my piece.)

In a world where there is a surfeit of acronyms, the fate of one more organization might not seem worthy of concern. But the survival of AAES—with its membership intact—would improve society's chances of coping successfully with its grave technological problems. Equally important, such unity would demonstrate that strong-minded people can find better ways to resolve their differences than walking away from one another. ☐

Continued from p. 9

registered ASME lobbyist in Washington. Many local and sectional groups approved the resolution before anyone understood that a Washington office with five staffers already existed.

Shaking the "Dirty Work" Label

The contrast between engineers and scientists is illuminating. Scientists, especially those who do basic research, are located predominantly at universities. Scientific journals are the key to the structure of the scientific community. If scientists wish to gain stature, they must publish. Scientists—until recently at least—were relatively unhampered by concerns about professional secrecy owing to industrial employment. As a result, a more definite hierarchy exists among scientists, and that community is more closely knit than the engineering profession.

To the envy of many engineers, scientists have long enjoyed certain advantages in Washington. The National Academy of Sciences, established during the Civil War, has given scientists a respected quasi-governmental voice. The National Science Foundation is charged with protecting basic scientific research and it has done just that—often at the expense of funding for engineering research. And presidential advisors have generally been associated with the scientific, rather than the engineering, community.

Perhaps the unkindest cut of all, scientists often get all the press: engineering ventures from the atomic bomb to the Apollo project have been hailed as great *scientific* triumphs. Engineers have sulked in the wings as physicists such as Robert Oppenheimer and Arthur Compton have taken center stage. Science has become a glamorous profession surrounded by glory and money, while engineering has never shaken its label of being the "dirty work" involved in "applying science."

Engineers, however, are beginning to prove themselves in Washington—with the help of the major engineering societies. These societies have organized lobbying efforts and media forums and encouraged members to testify before Congressional committees on important technological issues such as acid rain and nuclear-waste disposal. Prominent engineers have also tried to ease the sometimes sharp disagreements among the different societies. The IEEE, for instance, has long denied the existence of an engineering labor shortage. Instead, its members believe that employers often underestimate the mobility and adaptability of the present supply of engineers and overlook those with less formal education. In contrast, the American Association of Engineering Societies (AAES), the new umbrella organization, thinks that the number of new engineers must be drastically increased. Such disagreements can be not only embarrassing but damaging to engineers' quest for influence. As Paul Maxwell, staffer for the White House Committee on Science and Technology, explains, "If a group comes to me with a report predicting a shortage of engineers . . . I don't want another report to come out the following month with the opposite conclusion."

To forestall that kind of confusion, the Washington representatives of the different engineering societies have taken to meeting every month for lunch. And such cooperation has yielded results. For example, in 1980 these societies lobbied to reorganize the National Science Foundation. The new Directorate of Engineering was created as a separate agency as a result.

The formation of AAES may also help. An *Engineering Times* editorial observed that the meetings that led to the establishment of AAES probably represented more cross-society contacts than the profession had witnessed in 20 years.

Today, government agencies consult engineering societies more regularly, and engineers themselves hold more administrative posts in government. Most of the major disciplinary engineering societies now place engineers in Congress and the Executive Branch as policy interns for one or two years.

But the problem of political apathy and divisiveness remains. There may be no way to ferret out engineers who hide behind their design benches, or to eliminate the perpetual threats of secession from an umbrella association such as the AAES. Perhaps as government officials become more aware of the need for technical expertise, engineers may become more involved in policymaking. And just as important, they may finally realize that politics is not an "improper" activity for their profession. □

STEVEN L. SOLNICK, a frequent contributor to Technology Review, *is a Marshall Scholar at Oxford University.*

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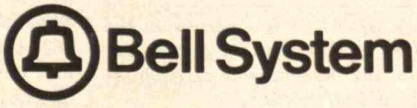
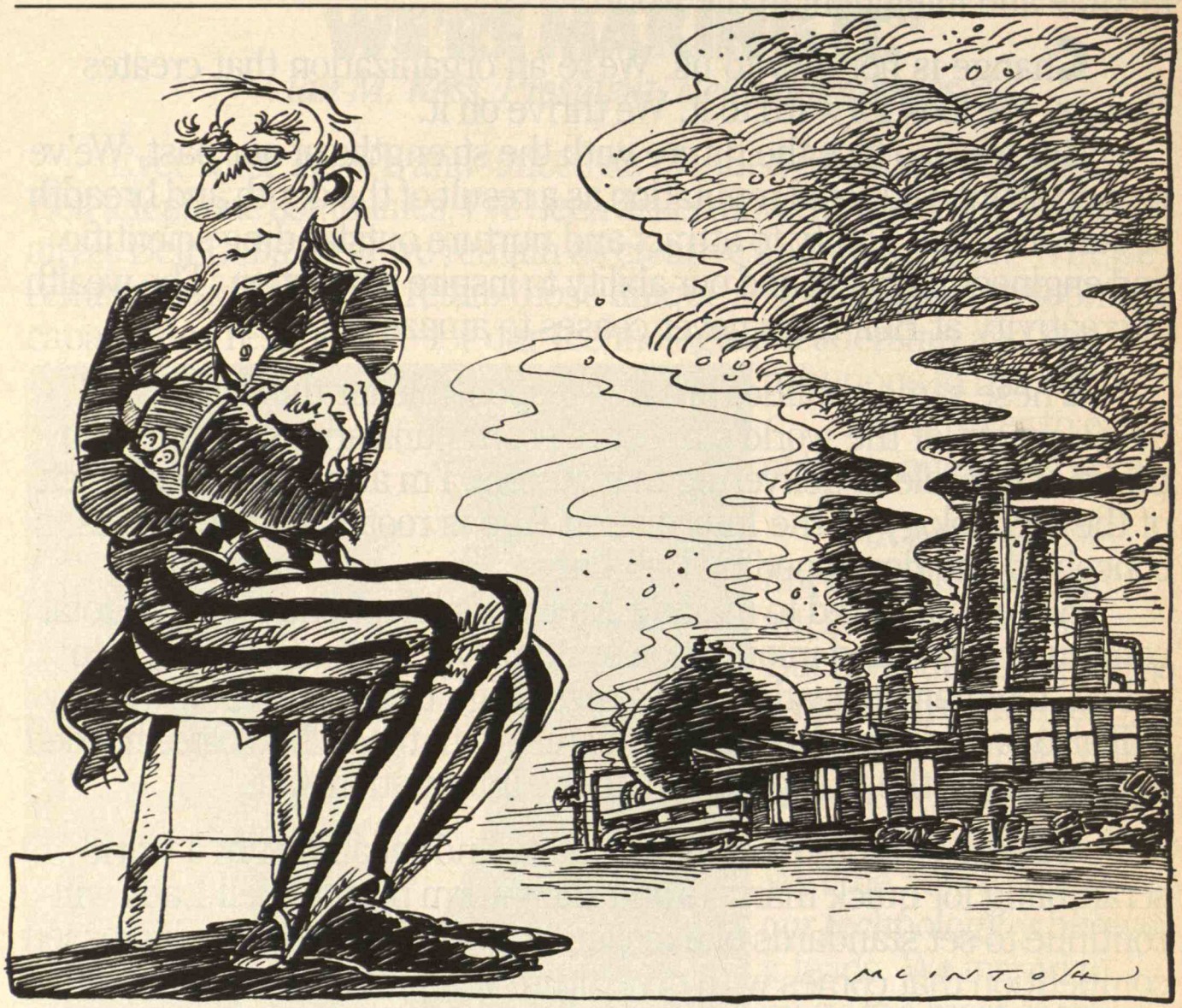


BY J. RAYMOND MIYARES

Controlling Health Hazards Without Uncle Sam



OVER the last decade, four administrations have sought to make the regulatory process less dependent on federal intervention. The current administration is making an especially concerted attempt to deregulate health, safety, and environmental hazards. By executive order, President Reagan has not only required federal agencies to conduct cost-benefit analyses of major new regulations before issuing them; he has also drastically reduced agency budgets, cut back on enforcement, and appointed officials committed to these goals. While many of these appointees have been replaced in recent months, the Reagan administration still appears unlikely to pursue aggressive new regulatory initiatives.

This does not mean that we, as a nation, have forfeited our right to control the panoply of environmental, health, and safety risks we face every day. Since federal regulation cannot do the whole job and will certainly not be used to its fullest extent in the near future, private alternatives must be found.

In cases of well-understood risks and technologies, the most obvious substitute for federal regulation is for industry to regulate itself. Toward that end, private firms invest considerable resources in developing health and safety standards for their own activities, often relying on industrywide or professional standards.

Industry currently follows as many as 60,000 such nongovernmental standards. These "consensus" standards cover products and services in the construction, electrical, metal, chemical, textile, and nuclear industries. To the extent that these stan-

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ILLUSTRATION: JON McINTOSH

dards define acceptable product quality and design in a particular industry, they keep nonconforming products and practices off the market. For example, compliance with standards developed by Underwriters Laboratories, Inc., is a minimum condition of marketability for many electrical products.

But many health and environmental risks are not as easy to define. Acid rain, pesticide misuse, the toxic by-products of industrial manufacturing, and defective products—all are sources of risk that arouse debate over how they should be controlled. In such cases, the development of voluntary consensus standards is difficult. And even if standards were developed, a lack of consensus would probably undermine their widespread use.

The Legal Remedies

Lawsuits are another alternative to federal regulation. In the past, the threat of legal liability stimulated many firms to adopt voluntary standards of conduct. Before various regulatory programs were created in the 1960s and 1970s, injuries from a perceived health hazard were almost exclusively remedied through law suits. Damage suits against product manufacturers proliferated. Today, hardly a week goes by without news of a large out-of-court settlement, or judgment, won by an injured plaintiff. For example, a California court recently awarded $6 million to the victims of a fire caused by the explosion of a gas tank in a Ford Pinto during a rear-end collision.

Such awards have certainly improved product safety—not only the products of the company held liable but also those of other manufacturers in the same industry. Heat-sensitive shutoff switches in hair dryers and collapsible steering columns in automobiles are examples of design improvements implemented because of judgments against manufacturers. These settlements put those engaged in similar enterprises on notice as to what level of safety will be demanded of them in the future. Furthermore, some unsafe products such as flammable children's pajamas have been driven from the market—or "voluntarily" withdrawn—because of the fear of liability.

More and more victims of exposure to toxic industrial chemicals are also seeking redress through the courts. In a federal district court in New Jersey recently, B.F. Goodrich was held liable for the death of a nearby resident whose cancer was determined to have been caused by exposure to the company's vinyl-chloride emissions. In Oregon, a federal district court ordered Martin Marietta Co. to pay damages to nearby residents because the emissions from the company's aluminum smelting plant were damaging fruit crops.

But proving that injuries are environmentally caused can be quite difficult. Evidence of the levels and duration of exposure may be hard to produce, and other causes may have contributed to the alleged health effects. Epidemiological data—statistical assessments of the incidence of disease in certain populations—are often too imprecise to shed much light on the specific case being tried. Furthermore, the long latency period of many diseases has sometimes proven to be a barrier to judicial relief. That's because some states have statutes of limitations, requiring that damage suits be filed within a set number of years after initial exposure to a toxic substance.

Clearly, some reform is needed if litigation is to effectively redress injuries incurred from exposure to hazardous substances. Environmental groups and others are stepping up their efforts to promote legislation that would make it easier for victims of exposure to hazardous waste to be compensated.

Insurance, a third alternative to federal regulation, is perhaps the oldest way of addressing risk. Insurance against marine perils existed as early as the twelfth century. Fire insurance first appeared in the seventeenth century, and product-liability insurance was introduced in the late nineteenth century.

In setting rates, insurance underwriters take into account the product or activity being insured, the ways in which it poses risks, the magnitude of potential injuries, and the laws governing such risks. Thus, insurers can identify at least the most unsafe clients and charge higher rates for risk-producing behavior. For example, auto insurance premiums usually reflect individual driver safety records. So drivers must maintain a safe driving record to prevent their rates from going up. Worker compensation insurance, in contrast, is more often based on general loss expectancies for a particular industry. Flood insurance rates, meanwhile, are based on federal flood estimates.

Of course, the value of insurance in en-

couraging safer management of risks depends on the insurers' ability to assess those risks. For some insurance lines such as environmental-impairment insurance, past experience is limited, and making detailed assessments of loss may be difficult and costly. Thus, insurance companies set uniformly high rates to protect themselves, and variations in safety practices have little effect on rates. In the 1960s and 70s, for instance, product-liability coverage was prohibitively expensive because insurers didn't know what the extent of the risk would be and priced their insurance coverage on the high side to protect themselves. Many companies could not afford such insurance and were ill-equipped to compensate the victims of defective products. However, this problem was remedied as insurers collected the information necessary to permit them to better evaluate risks. Today, product liability coverage is underwritten on a more precise and affordable basis.

A fourth alternative to regulation, providing information to consumers, can be quite effective. The National Highway Traffic and Safety Administration's *Car Book*, which rated new models on safety and performance features, was so powerful in swaying public opinion that it was withdrawn from publication after intense lobbying by automobile manufacturers. The book was later published with private funds. When consumers became aware of the possible effects of fluorocarbons from aerosol sprays on the earth's ozone layer and boycotted certain products, the industry decided to use other propellants or replace spray nozzles with pumps. And a product safety rating of "unacceptable" from *Consumer Reports* magazine may induce a manufacturer to alter that product quickly.

However, the Reagan administration seems very reluctant to distribute information on environmental, health, and safety risks to consumers. The administration recently rejected a proposal from consumer groups to require ingredients to be labeled on wines and beers, many of which contain chemical additives. Mandatory labeling showing the energy consumption of major appliances is being discontinued, even though there is evidence that such labels substantially alter consumer choices. For example, while consumers prefer heavily insulated water heaters that cost more but save on energy, buyers may well choose models that are cheaper in the short run if such information is no longer readily available.

An administration committed to letting free-market mechanisms operate might do well to rethink its position and make such information available. If product information were widely available, consumers would probably make choices that would encourage industry to make safer and more environmentally benign products.

Contract negotiation is a fifth alternative to regulation. Labor unions have often bargained for better and safer working conditions, sometimes trading higher wages and more fringe benefits for such improvements. The United Steel Workers and ASARCO, a multinational company that processes ore, recently negotiated an agreement to protect workers against exposure to arsenic. The International Labor Organization has also relied on collective bargaining to improve protection of chemical-industry workers.

Bargaining for Better Health

Negotiations are also being used to settle public environmental controversies. For example, the Massachusetts law governing siting of hazardous-waste treatment facilities provides funding to communities to negotiate with developers and hire consultants. The law requires developers to obtain community approval for the waste facility's design, construction, operation, and maintenance and to compensate local residents for any adverse effects. The idea is to facilitate a trade-off between the environmental risks of such a facility and the economic and social benefits its developers can provide to the community.

Such negotiations can, of course, be unwieldy and slow. In Massachusetts, developers have been unable to win community approval for any waste facilities. But if all parties could agree on the safety measures to be adopted, the need for federal regulation would be lessened.

Each of these alternatives is most effective in certain contexts, and none is a complete means of regulating hazards. Indeed, all remain subject to the same criticism that led to heavier reliance on federal regulation in the first place. Industry is sometimes indifferent to safety or health concerns that conflict with its financial interests. The threat of liability for injuries created by industrial activity can be too remote to have a genuine impact. Insurers may not take into account the huge variations in safety practices when setting rates. Corporations may manipulate consumer preferences for clean air, pure food, and safe products. And multiparty contract agreements regarding health risks may be difficult to achieve.

Nevertheless, federal regulation is not the only game in town—perhaps not even the most important one. Even the most efficient regulations cannot eliminate all health, safety, and environmental hazards. Therefore, we must rely more heavily on private alternatives even while regulators are taking their ball and going home. □

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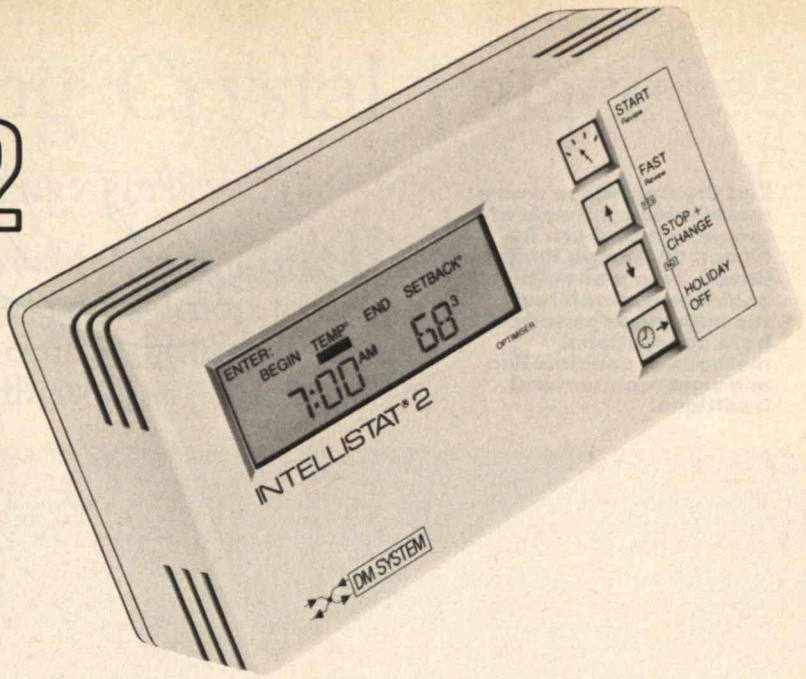

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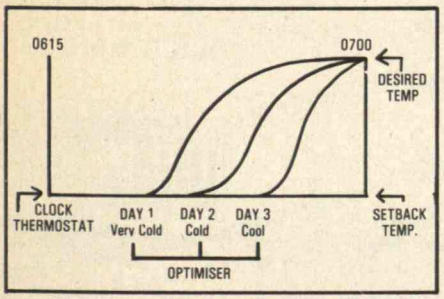

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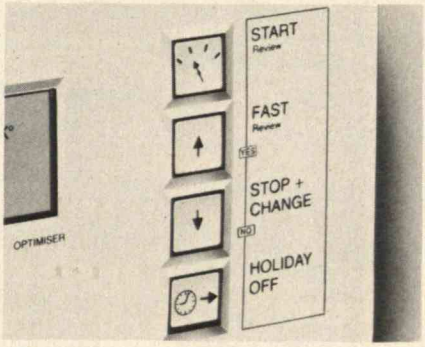

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The Amazing Crystal Palace

BY HENRY PETROSKI

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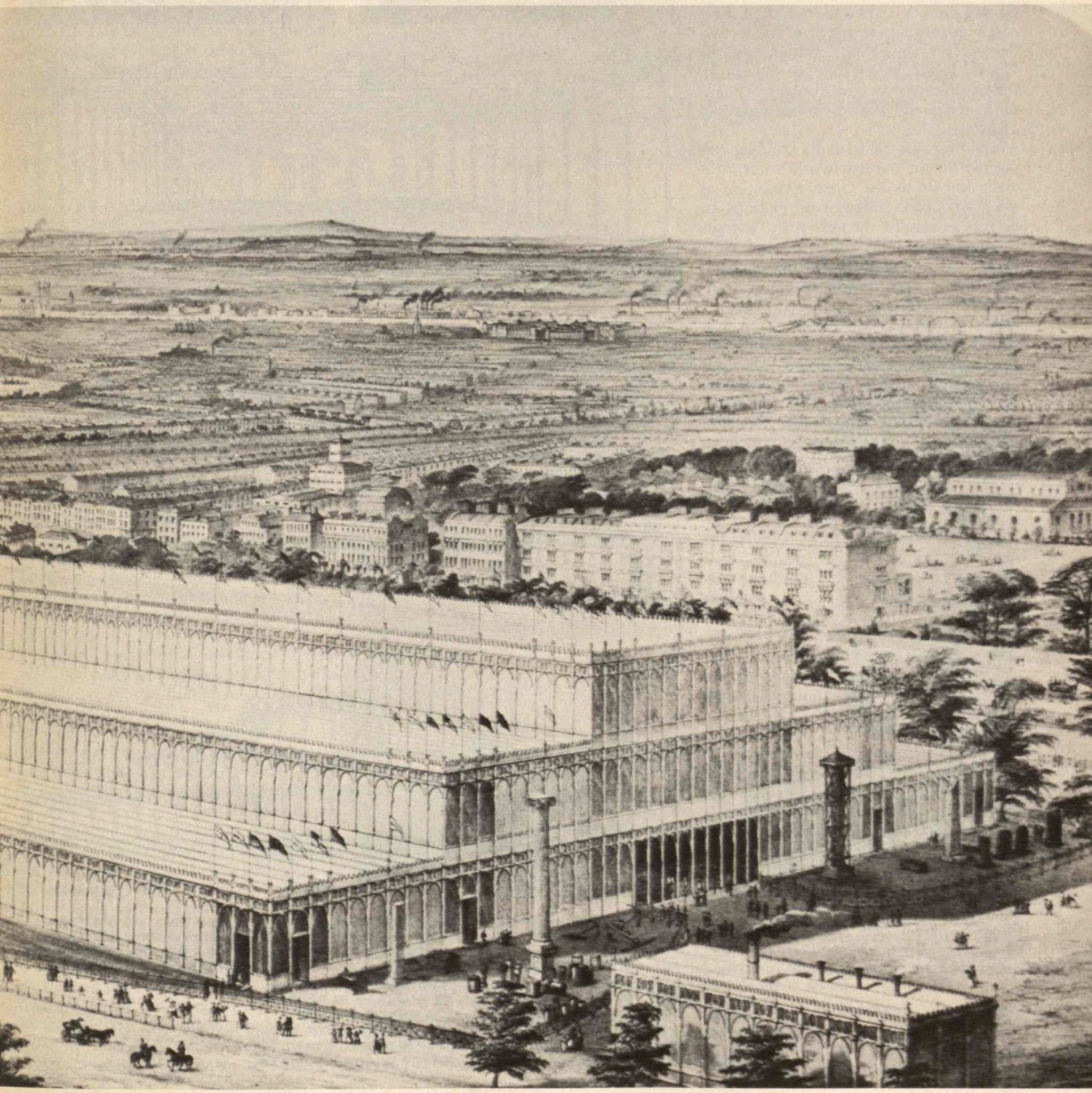
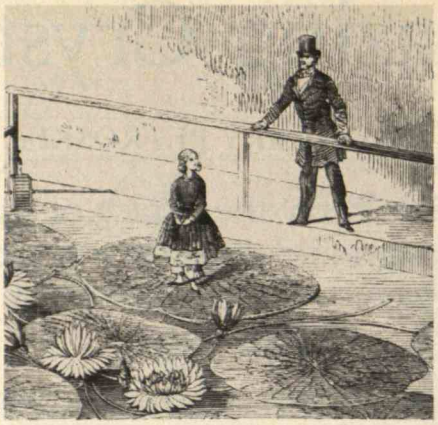
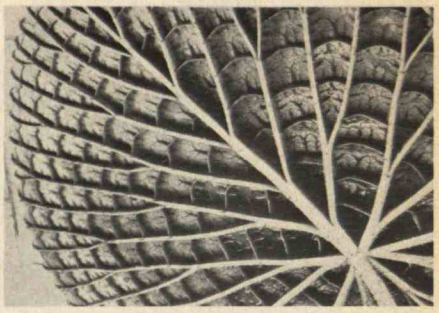
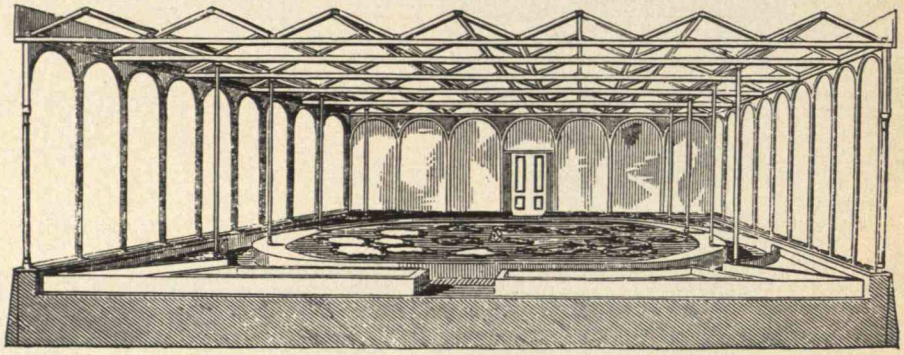
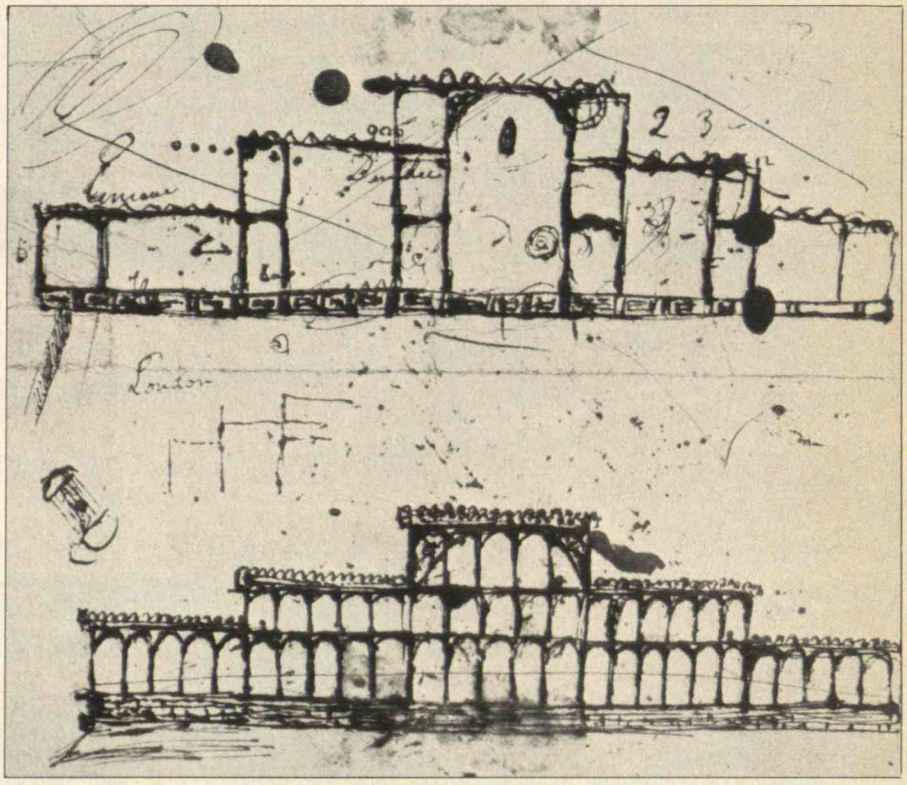










A giant water lily inspired the Crystal Palace. Paxton observed that the leaves, strong enough to support his daughter, owed their strength to the geometric pattern of ribs and crossribs on the underside. Following that model, he designed a glass house especially for the lilies (structural view at center), which he named *Victoria regia* in honor of the queen. Paxton's first sketch of the Crystal Palace (above), based on the lily house, was done on blotter paper during a business meeting. He completed the design within a week.

ONE of the most significant architectural and engineering achievements of the nineteenth century was conceived by neither an architect nor an engineer, but a gardener who once needed to keep a water lily warm. "He builded wiser than he knew," wrote journalist Horace Greeley of Joseph Paxton, whose Crystal Palace housed the Great Exhibition in London. Indeed, Paxton's spectacular creation succeeded beyond everyone's expectation. Yet the Crystal Palace, which stole the show from the exhibition's myriad displays of manufactured goods, was very much a product of its age.

The time was 1850, and a building was needed for the the first world's fair, officially known as the Great Exhibition of the Works of Industry of All Nations, to be held in London the next year. Paxton's Crystal Palace, the first large and truly significant building constructed of metal and glass, was prefabricated in standardized units and erected in only 17 weeks. But perhaps the building's greatest contribution was in its remarkable synthesis of technology and art—the first major application of iron in architecture for aesthetic and not purely structural purposes. In short, the design and construction methods proved to be models for architects and engineers of the next century, and the features of the Crystal Palace are reflected in today's most modern buildings.

Joseph Paxton was born in 1801, the son of a farmer in Bedfordshire. As a young man he became a gardener employed by the Duke of Devonshire, and by 1826 he was superintendent of the gardens at Chatsworth, the duke's Derbyshire estate. Paxton also displayed a special talent for structural design, and by 1840 he had built a greenhouse enclosing an acre of ground. This Great Conservatory was considered a "modern" marvel.

It was into one of the heated tanks at Chatsworth that Paxton first placed a cutting of a giant water lily obtained from Kew Gardens, the Royal Botanic Gardens near London. The seeds had been brought back from tropical British Guiana in 1837, but the plant did not thrive at Kew. Under Paxton's care, however, the plant developed the huge leaves and beautiful flowers characteristic of such lilies. He named the flower *Victoria regia* (now called *Victoria amazonica*) and presented a bud to the queen.

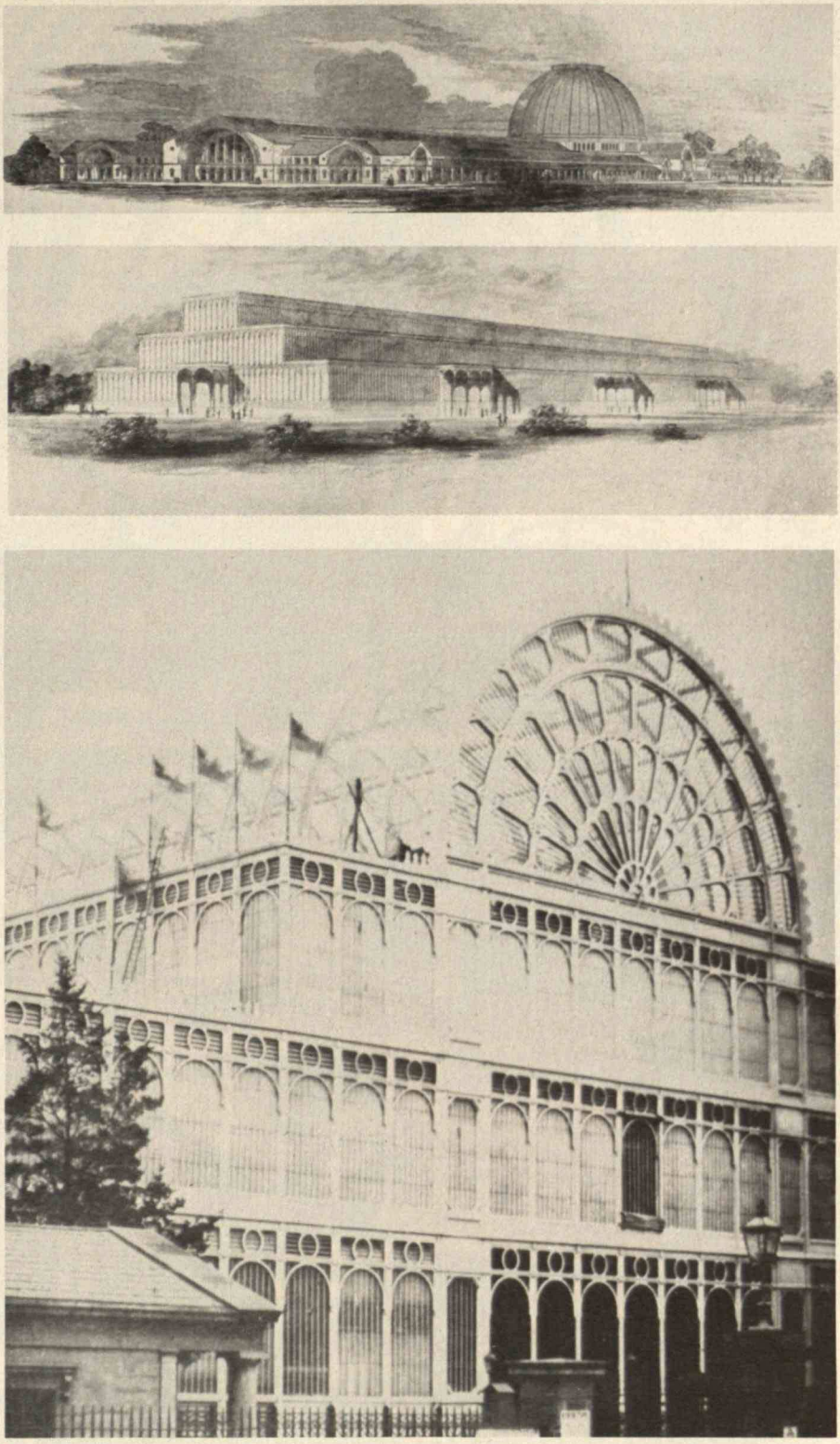
As the lily continued to grow, Paxton designed a building especially for the plant, taking the structure of the lily house from the structure of the lily leaves them-

selves. Paxton had once placed his young daughter on one of the leaves, which were five feet in diameter, and noticed that its buoyancy easily supported her weight. He observed that the leaf owed its strength to the geometric pattern of ribs and cross-ribs on its underside, and took that as a model. The result was a building 60 feet by 47 feet, with a glass roof resting on wooden beams set across iron girders supported by iron columns. This light and airy building eventually provided the idea for the Crystal Palace, which would measure over 1,800 feet by 400 feet and shelter the 100,000 exhibits of the Great Exhibition.

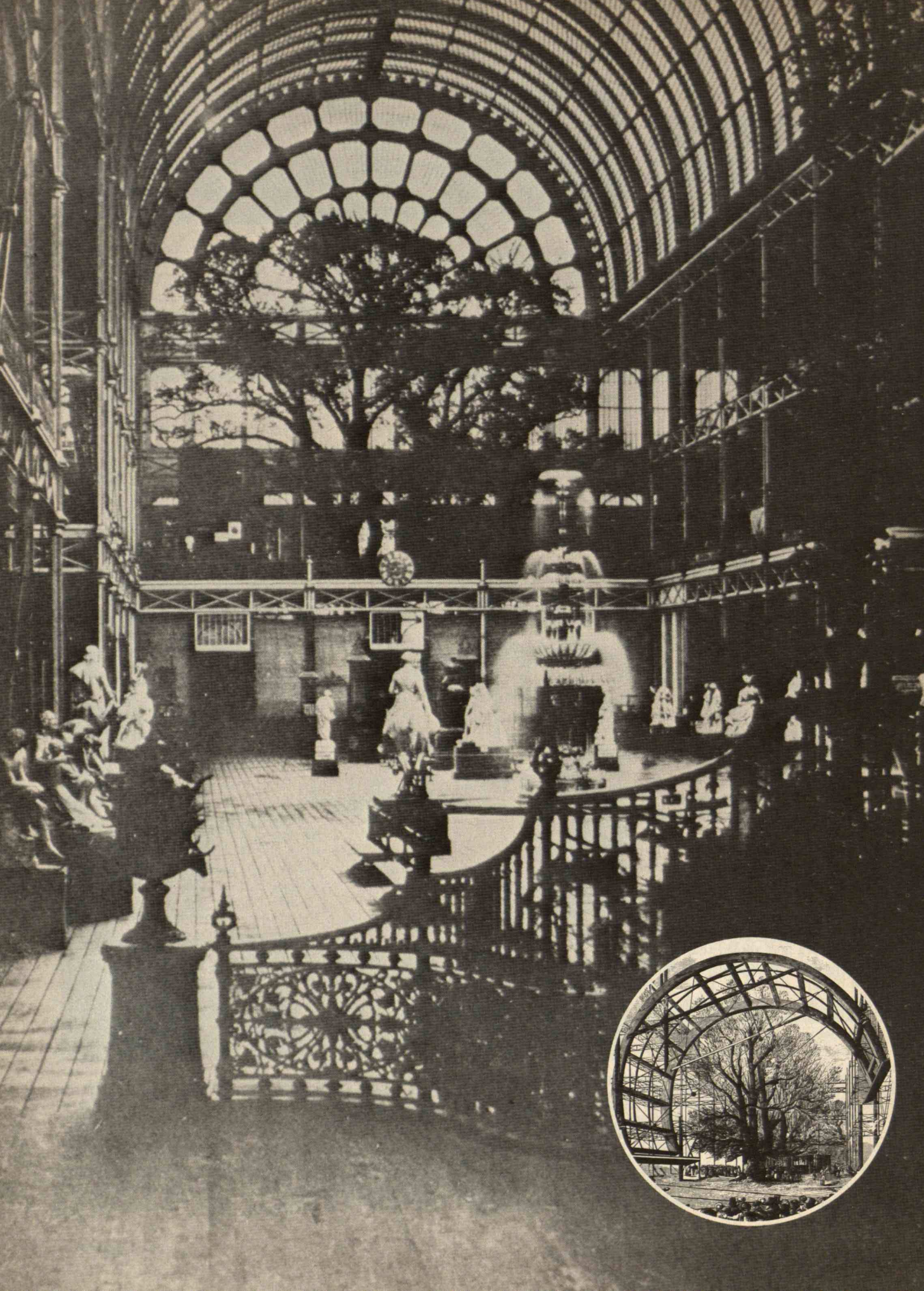
The Stage Is Set

Just as the world of commerce was ready at mid-century for the first international exhibition of the works of industry, so was the world of technology ready to build the Crystal Palace. The British government had repealed the century-old glass excise tax in 1845, removing any fiscal impediment to using almost 300,000 panes of glass in the building. The United Kingdom was producing about 5 million tons of cast iron and wrought iron annually, more than 1,000 times the amount required, which at 4,500 tons was still enormous. And although the scale of the Crystal Palace was indeed grand, the engineering experience gained in developing the nation's railroad system, which included hundreds of iron bridges, provided the knowledge about the strength of materials necessary to execute the bold design. Nevertheless, the Great Exhibition came to be housed in the Crystal Palace only at the eleventh hour.

An exhibition of international scope was first suggested by Henry Cole, a public servant whose indefatigable energies and interests made him a driving force behind Victorian architecture and industrial design. Prince Albert immediately embraced the idea and agreed that Hyde Park would be the best site. Early in 1850 the prince became chairman of a Royal Commission to promote the project, and soon a building committee was appointed. This committee envisioned a temporary structure covering 16 acres and announced an open competition to select the design. However, the committee found none of the 245 entries acceptable and proceeded to cannibalize them for what it considered the best features to produce its own design. A rendering of the committee's camel of a building was published in the *Illustrated London News* in June and was panned immediately by the *Times*.

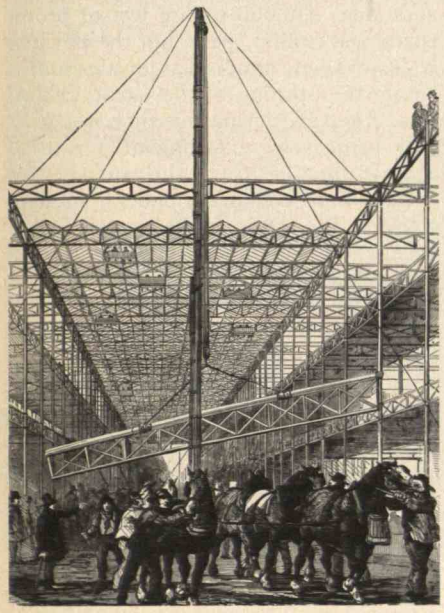


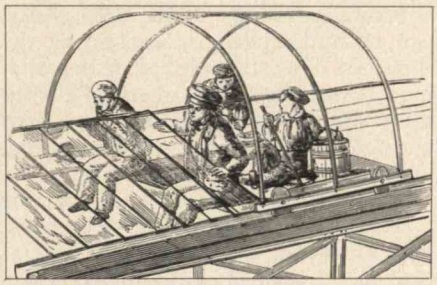
The exhibition's building committee cannibalized features from various entries in the design competition to produce its own official design (top). Criticized as a "vast pile of masonry," it would have required the laying of 15 million bricks. Paxton's last-minute entry (center)—an iron and glass concept—eventually gained favor because of its simplicity and economy. To overcome protests that a group of elms would be cut down to make room for the building, Paxton added an arching central transept to enclose the 90-foot-tall trees.

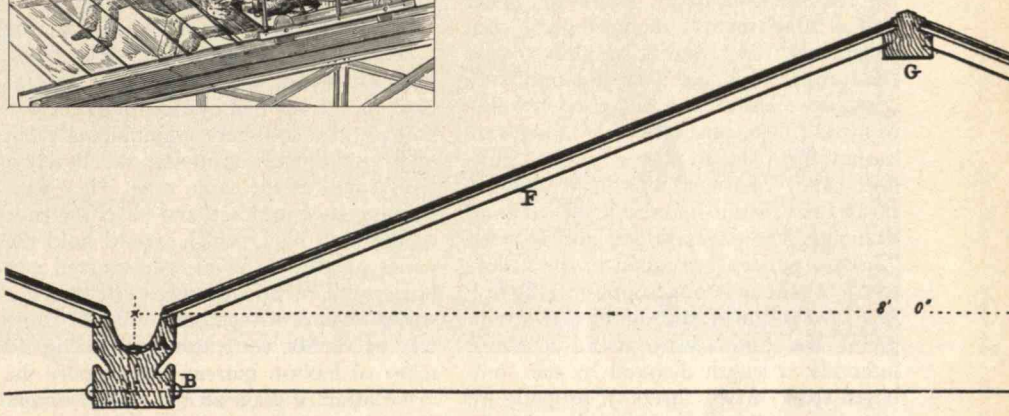


Shown during construction (inset left), the transept became one of the building's most distinguishing features. This photograph of its interior (left), complete with a 4-ton cut-crystal fountain, was taken on Sunday when the exhibition was closed.

Paxton's patented "ridge-and-valley" roof was not only pleasing to the eye but provided good drainage. Panes of glass sloped into wooden "Paxton gutters" (below right), installed in the valleys to carry rain and condensation to the hollow iron columns that doubled as drainpipes. To simplify construction, workers installed the glass as they moved along on trolleys (below) that rolled on wheels set in the gutters. The gutters were spaced 8 feet apart, a length dictated by the combined span of two sheets of gently inclined glass. Roughly three times this length, or about 24 feet, was a convenient length for the cast-iron girders, and their supporting columns were placed at 24-foot intervals. Thus, 24 feet became the basic unit of scale for the entire Crystal Palace. Interior avenues that stretched the length of the building were spanned by wrought-iron trusses 48 feet long. The spectacular Central Avenue, shown under construction (below left), was three units, or 72 feet, wide.







Critics described the proposed structure as a "vast pile of masonry" that they feared would never be removed and would become a "permanent mutilation of Hyde Park." Indeed, the committee's malproportioned behemoth would require the laying of 15 million bricks and the construction of a dome 200 feet in diameter, considerably larger than that of St. Paul's Cathedral. Even the mortar was not expected to be dry in time for the opening of the exhibition, less than a year away.

Meanwhile, the exhibition itself and its location were debated in Parliament. Xenophobic opponents feared the effects of foreign competition on the sale of British goods at home and abroad, while others cited less commercial concerns. One particularly vocal opponent was Col. Charles Sibthorp, a protectionist who also had opposed the Public Libraries Act of 1850 because, among other reasons, he "had not liked reading at all." His most celebrated objection to the exhibition site involved a small clump of elm trees marked to be cut down. Reason prevailed in Parliament, however, and the protests of Col. Sibthorp and his sympathizers were suppressed, though the issues didn't entirely disappear.

Late Entry

Paxton did not enter the original competition because, according to his own account, he took it for granted that the building committee would select a suitable design without his help. But he was disappointed in the plans, which were being discussed more or less publicly, and wondered if it were not too late to put forth an idea. Although he approached exhibition officials only a fortnight before the building committee's choice was to be formally announced, Paxton persuaded them to allow another entry. That committment was obtained on June 11, and he completed his design within a week.

At first the building committee poohpoohed the new proposal, but it gradually gained support. And after a rendering of the design was prematurely published in the *Illustrated London News* on July 6, the committee soon abandoned its own design and unanimously embraced Paxton's "ferro-vitreous"—iron and glass—concept. Among the advantages were the building's extreme simplicity, the speed with which it could be assembled, its absence of internal walls, and the fact that the materials could be reused. The economic advantages of lower construction costs and high salvage value seemed to clinch the design's choice. (Indeed, the Great Exhibition—unlike virtually all subsequent world's fairs and international exhibitions—made a handsome profit, certainly in part because of the economy of the Crystal Palace.)

However, the fate of the elms in Hyde Park still cast a shadow, and Paxton added to his original design a central transept that would enclose the 90-foot-tall trees. Construction began even without a firm agreement with the contractor, Messrs. Fox, Henderson, and Co., and a contract would not be signed until more than a month later. The price agreed upon was 79,800 pounds to erect and later dismantle the building, with the contractor owning the materials. The final cost of the Crystal Palace, including modifications such as the transept and other additions, was 200,000 pounds. Still, this works out to about 25 pounds per 100 square feet of covered ground, a bargain even in the mid-nineteenth century.

Workers fenced in the construction site in August, with the same wooden planks that would be used later for the floors and galleries. Completion of the project was

The Great Exhibition of the Works of Industry of All Nations featured examples of just about everything manufactured in the mid-nineteenth century. This lithograph (right) shows the display area for state-of-the-art machinery.

scheduled for January 1851, which allowed just over 20 weeks to enclose 19 acres with massive amounts of iron and glass. The ground was leveled, foundations and iron drainpipes were laid, and the first column was erected on September 26. Construction proceeded quickly, by the light of bonfires at night, and on one Saturday Paxton reported seeing two columns and three girders put up by two men in only 16 minutes.

The mathematical regularity of the Crystal Palace's proportions helped simplify construction. Paxton determined the basic unit of length for the building not by some aesthetic "golden section," but by the requirements of the exhibition space and a fundamental technological constraint: In 1850, sheets of glass longer than about four feet were not only very costly to manufacture but also unwieldy to install. Thus, panes 49 inches long were mounted on the roof in a gentle "ridge and valley" pattern that was not only pleasing to the eye but also provided good drainage. The panes sloped into wooden "Paxton gutters," installed in the valleys to carry rain and condensation to the hollow iron columns that doubled as drainpipes. The gutters were placed at 8-foot intervals, a length dictated by the combined span of two sheets of properly inclined glass. Roughly three times this dimension, or about 24 feet, was a convenient length for the cast-iron girders, and their supporting iron columns were placed at 24-foot intervals. Lighter wooden trusses were mounted atop the girders to support the gutters. Thus, 24 feet became the basic unit of scale in the plan for the entire Crystal Palace.

Wide interior "avenues" that stretched the length of the building were spanned by wrought-iron trusses 48 feet long. And the spectacular Central Avenue was spanned by trusses three units, or 72 feet, long. The arched central transept also spanned 72 feet. This bare and simple geometric regularity no doubt contributed to the structure's graceful appearance, just as the repetition of basic units of glass or marble facing work so effectively in modern architecture. The 77 24-foot units along the south facade of the building were also numerous enough to distract all but the most observant eye from the fact that the central transept was not central at all, but was off center by one unit to accommodate Col. Sibthorp's elms.

Functional Beauty

The uncommon depth of the girders and trusses—roughly 3 feet—added to the grace of the Crystal Palace when a visitor looked down one of the long avenues. And in Paxton's usual custom, this aesthetic feature served a structural purpose as well: Attaching the trusses and girders to the supporting iron columns not only at the top but also at their relatively deep bottom provided a great stiffness against wind and other lateral forces. The structural advantage of the deep girders can be appreciated by comparing the flimsiness of a card table having thin folding legs with the rigidity of an old kitchen table whose top is supported on deep wooden side beams attached solidly along their entire depth to firm legs.

The construction techniques, like the building design, also speeded up progress. For example, workers used special machines developed by Paxton to cut several wooden sash bars simultaneously out of a single plank, grooving and beveling their edges at the same time. They used circular saws to notch and bevel the ends of the sash bars, which would hold the panes of glass in place, and pierced nail holes with revolving augers driven by a steam engine. Altogether, 600,000 cubic feet of timber were used, including 24 miles of Paxton gutters. To simplify the installation of glass on the roof, workers first prepared the sash bars with putty and then fitted the panes—all as the workers moved along on specially designed four-person trolleys that rolled on wheels set in the tracks of the Paxton gutters.

Questions about the strength of the Crystal Palace arose from the beginning, but its design and construction made no compromises with safety. Wherever the girders and trusses did not provide sufficient lateral stiffness, inconspicuous diagonal rods were installed in cross patterns. These rods were used extensively in the arched central transept and their oblique pattern even broke up what might have been the monotony of the great space. Workers tested all cast-iron girders at the construction site—using a hydraulic press made for the purpose—achieving a degree of quality control rarely matched even today. They also tested the double-length and triple-length wrought-iron trusses, but needed to test only one of each type since the wrought iron by its nature would be of uniform quality.

Criticism continued throughout construction, however, and nay-sayers warned that wind and hail would bring the glass box down, or that heat and humidity would make it unbearable in the London summer. Neither happened. The Crystal Palace withstood the elements and proved to be as cool (thanks to canvas suspended above the roof) and dry (thanks to the Paxton gutters and the hollow columns) as one could wish. But if the forces of nature would not be its undoing, the masses of visitors would—or so said the predictors of doom.

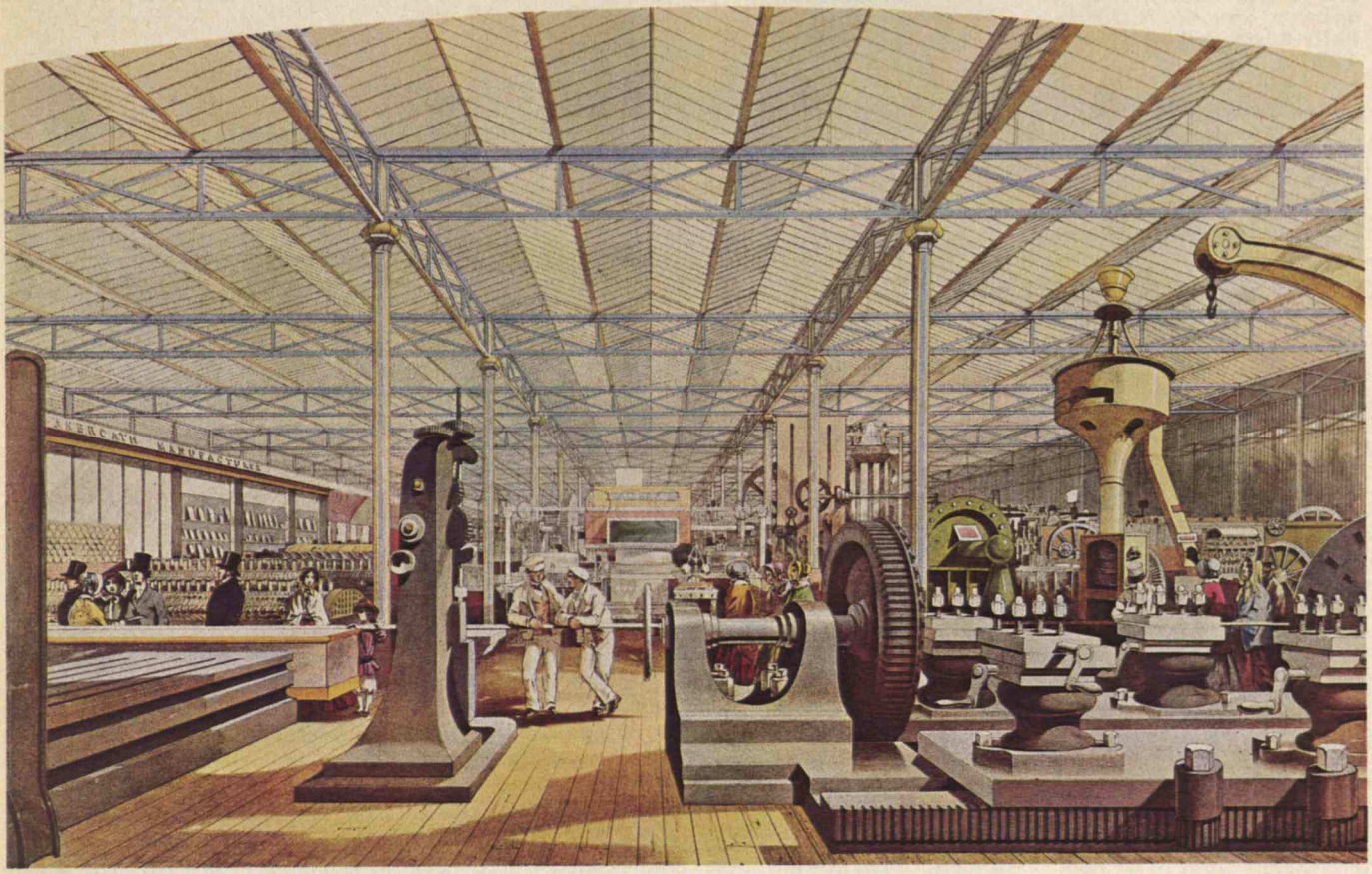
Miles of galleries were to provide an additional 200,000 square feet of promenade and exhibit space, but the elevated walkways were attacked as unsafe months before the opening of the Great Exhibition. After all, during this time iron railway bridges were failing at a rate of almost one in four, and suspension bridges were collapsing under marching soldiers. The safety of the Crystal Palace galleries had yet to be demonstrated. As a test, a section of gallery was constructed just off the floor. Then Queen Victoria, on one of her inspection tours, witnessed weights rolled across it, workers stamping upon it, and troops treading across it in measured step. The specimen gallery withstood it all.

The Science of Color

The Crystal Palace was unique not only in its structural details but also in its maintenance and decoration. The floor boards, for example, were laid with a space between each board so that dirt and debris could fall or be swept between the cracks, preserving a neat and dustless promenade. Floor-sweeping machines were originally used to push the dust into the half-inch spaces between the boards, but they proved unnecessary as women's dresses accomplished the same end. Small boys were employed to crawl beneath the floor boards and collect bits of paper that might otherwise collect and present a fire hazard.

All the decorative and ornamental details for the building were under the direction of Owen Jones, known as "Alhambra" Jones because of his great knowledge of Moorish architecture. In painting the structural elements, Jones applied his "science of color." His contemporaries did not universally applaud the result, but it is difficult to judge today because all original hand-colored prints have long since faded. However, the colors have often been described in words.

Pale blue was the predominant interior color of the vertical metalwork, and this is believed to have enhanced the feeling of open space. The underside of every girder was painted strong red, a color repeated in screens against which many of the exhibits



stood. Yellow was used on molded details and highlighted the fluted portions of the otherwise blue columns. All in all it must have been a striking palette. A further touch of color was added on the exterior by displaying flags of all nations on a thousand poles around the periphery of the roof. (Sir Charles Barry, one of the organizers of the Great Exhibition, suggested this.) The flags had the remarkably pleasant effect of breaking up the monotonous straight line of the long roof in a most appropriate way.

Another example of Jones's attention to detail was an electric clock with a face 24 feet in diameter located above the central transept's south entrance. The clock might have dominated and disfigured the transept had he not abandoned the traditional circular arrangement of the hours for a "face" that exploited the design of the transept itself. The numerals were arranged in a semicircular pattern on the arching transept's radiating structural components. Then instead of a single hour hand that swept in a circle every 12 hours, the clock had an hour hand (really two hour hands) that looked like a propellor. It revolved only once every 24 hours, with one side of the propellor indicating the hour at any given time. The minute hand was similarly designed.

Superb Design to Outrageous Excess

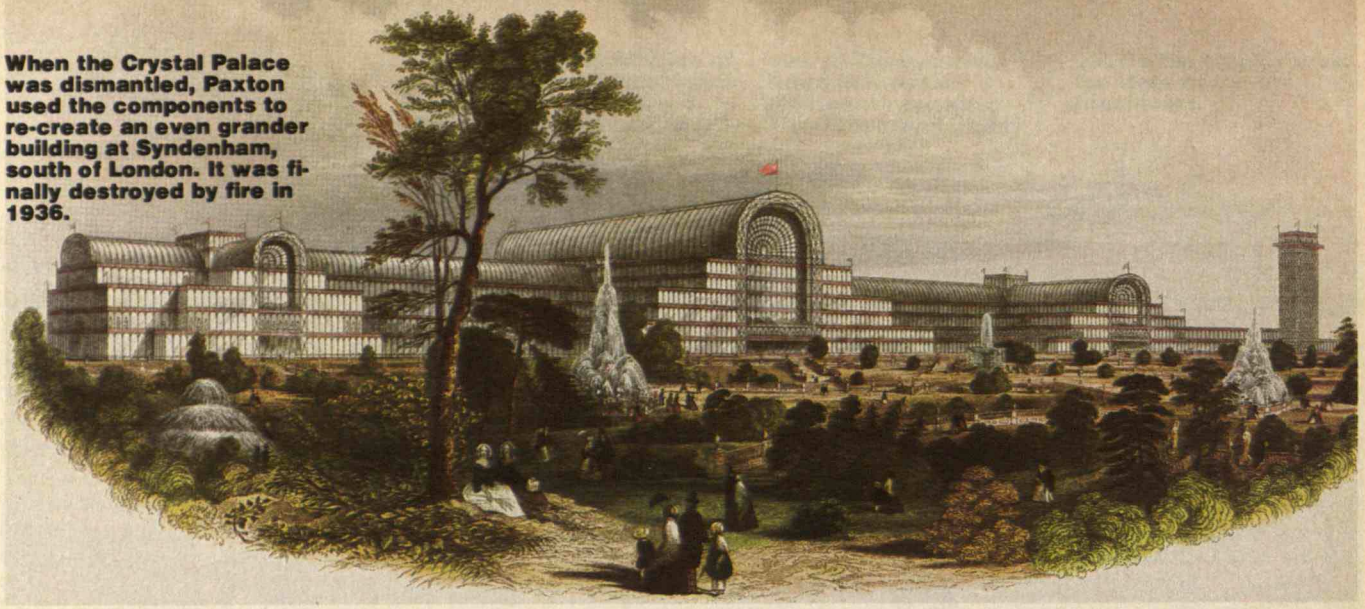
The works of all nations began arriving early in 1851 and, as they began to fill the Crystal Palace, excitement about the exhibit's grand opening, set for May 1, grew. Still, one last-minute complication threatened the exhibition—it seems the elms inside the transept had attracted countless sparrows. They flew inside the length and breadth of the Crystal Palace, perching on girders and trusses and posing inevitable problems for the assembled treasures below. The pesky birds could not be scared away with stones or birdshot, of course, for people in glass houses must refrain from doing certain things. Finally, officials sought the advice of the Duke of Wellington, and the Iron Duke suggested the solution in a single word: "sparrow-hawks."

Queen Victoria opened the Great Exhibition with much pomp and circumstance before an assembly that included numerous foreign officials and functionaries. More than 6 million people visited the exhibition during the 141 days it was open. (It was closed on Sundays.) The busiest day saw more than 100,000 visitors, with 90,000 people in the building at a single time.

The exhibits ranged from a collection of German stuffed frogs in human poses, which the queen thought "really marvellous," to the Koh-i-Noor diamond displayed securely in a gilded birdcage. There were numerous statues of bare-breasted women and fig-leafed men, pieces of furniture of every design, pottery, silver, glassware, jewelery, fabrics, clocks, and just about everything else manufactured in the mid-nineteenth century. The exhibits ranged from the artistic to the ridiculous, with the finest examples of high Victorian design juxtaposed against the most outrageous excesses of imagination. Although William Morris, the great designer who would strongly influence Victorian taste, hated the tastelessness of the industrial products displayed, he admired the Crystal Palace itself.

Indeed, the manufactured items on display paled beneath the magnificence of the Crystal Palace housing them. The great vault of the transept, enclosing the thriving elms, drew the eye like a multifaceted gem playing with the colors of the sun shining through it. And a visitor looking down each open avenue would be struck by the converging regularity of the columns and the girders spanning an open tunnel of light.

The queen returned to the Crystal Palace about 50 times before the Great



When the Crystal Palace was dismantled, Paxton used the components to re-create an even grander building at Syndenham, south of London. It was finally destroyed by fire in 1936.

Exhibition closed on October 15, and she never seems to have tired of spending hours methodically touring the exhibits. Her journal entry on the closing day reads: "To think that this great and bright time is past, like a dream, after all its success and triumph."

Although the Crystal Palace was supposed to have been dismantled after the exhibition so that Hyde Park could be restored to its unimproved state, officials seriously considered leaving the scaled-up lily house where it was. Some wanted to turn the structure into a Winter Garden where people could ride and walk among flowers during the dreary days of the long British winter. The costs of adapting the building for permanent use in Hyde Park, as opposed to dismantling it and re-erecting it elsewhere, were compared in great detail. But Col. Sibthorp, remembering the elms, opposed permanent installation. Various proposals for relocating the building were forthcoming.

Among the daring proposals for reusing the columns and girders was Prospect Tower, conceived to be 1,000 feet tall. This tower would certainly have been an economical use of ground, as its designer pointed out. The tower would have sported a clock 45 feet in diameter with numerals 10 feet high, and proponents were sure its glass exterior would withstand the great forces of the wind. This precursor of the modern skyscraper was a century ahead of its time and would compare favorably with the designs of today. However, it would certainly have taxed the elevator technology of the 1850s.

Indeed, although the true skyscraper did not really come into its own until the twentieth century, the Crystal Palace prefigured it in many important ways. The light, modular construction ingeniously stiffened against the wind is the essence of modern tall buildings. And the innovative means by which the walls of the Crystal Palace hung like curtains from discrete fastenings, rather than functioning as integral load-bearing parts of the structure, is the principle behind the so-called curtain wall of many modern facades.

The Crystal Palace inspired much contemporary architecture as well. For example, Victorian iron-and-glass railway stations were obvious precursors as well as proud descendants of Paxton's masterpiece. And the idea of international exhibitions spread quickly throughout the world. In 1853 New York hosted a world's fair in a cruciform iron-and-glass "palace" topped by a dome 168 feet high. Here Elisha Otis demonstrated a new safety device for elevators—a milestone in mechanical engineering that, like the civil-engineering milestone of the Crystal Palace, was essential to the development of the true skyscraper. Otis ascended in an elevator cage to dangerous heights above the floor and, before a gasping audience, cut the supporting rope. The elevator started to fall but was stopped by Otis's simple gravity-activated locking device that gripped the guideropes.

Crystal Palace Redux

Although the Crystal Palace was doomed, Paxton had other plans for the building for which he had been knighted. Dismantling began in the summer of 1852, and the columns and girders, gutters and glass, were transported to 200 wooded acres atop Sydenham Hill, south of London. Paxton raised over half a million pounds to purchase the Sydenham site and the building's construction materials.

The Sydenham Crystal Palace was to be more than a re-creation of the original structure, however. The roof was vaulted along its entire length, and the central transept was greatly enlarged and doubled in width so as not to be overwhelmed by the new roof. The enlarged transept in turn demanded the addition of two stories and two end transepts for balance. The final cost of the project, which included extensive gardens and fountains, was 1.3 million pounds. Part of the extra expense was for two tall water towers built to supply the elaborate fountains that were to rival Versailles.

The building at Sydenham provided myriad diversions for Londoners for decades. Fire destroyed the north transept in 1866 and the remaining asymmetrical memorial to Joseph Paxton and the original Crystal Palace withstood wind and hail, if not waning interest, for many more years until another fire destroyed the entire structure in 1936. The two water towers remained standing until they were demolished in 1940, presumably because they might serve as beacons for enemy bombers looking for London.

Today a television transmission tower stands on the sorry site, and in its shadow is a bust of Sir Joseph Paxton atop a cracking stone column. Throughout nearby London, and throughout the world, architectural descendants of the Crystal Palace abound. But no matter how tall, they do not seem to approach the greatness of their progenitor.

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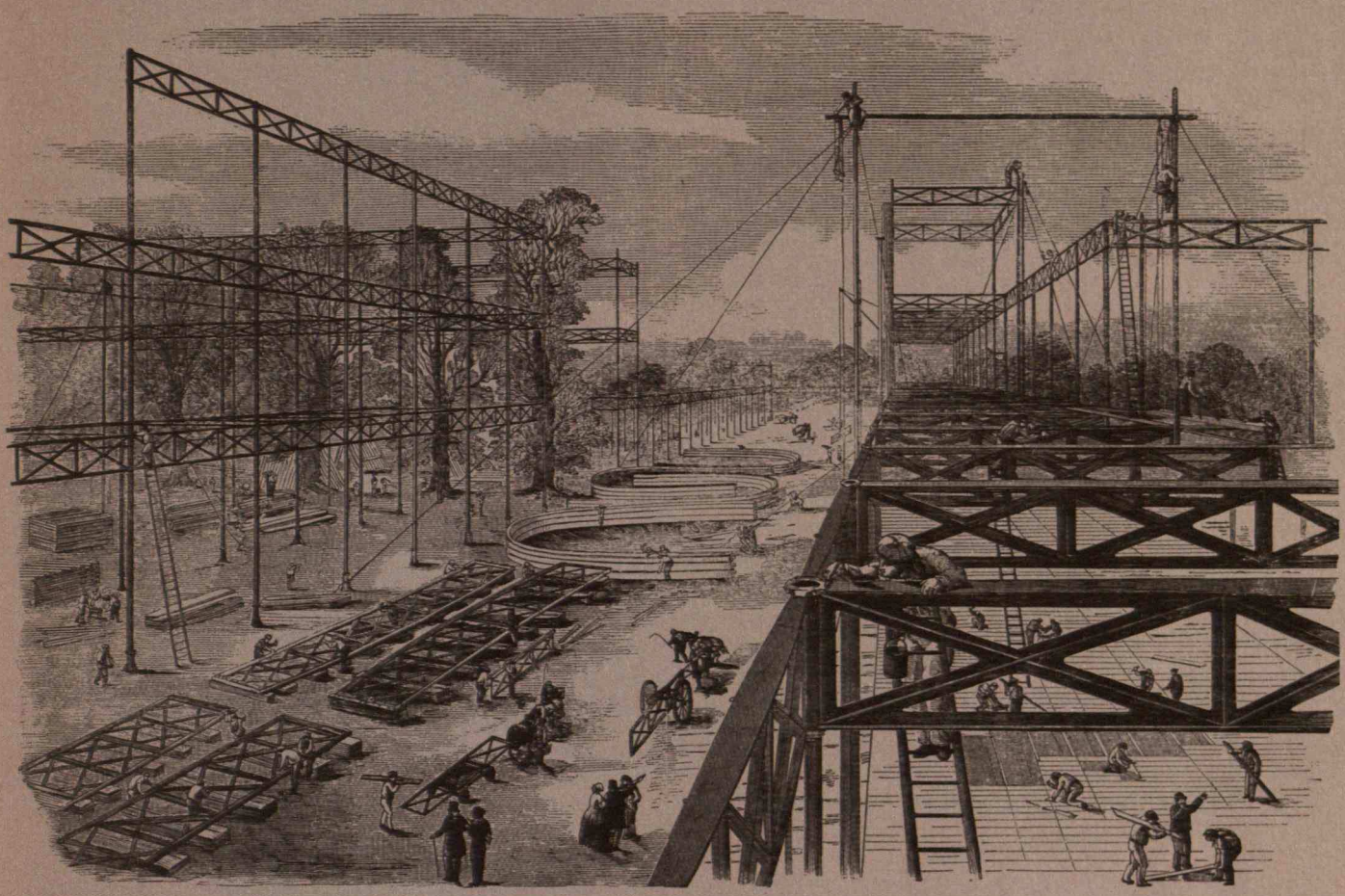
The illustrations in this article were reproduced from the following books: *The Glass House* by John Hix, John Hix Architects, The MIT Press; *The Great Exhibition of 1851* by C. H. Gibbs-Smith, Her Majesty's Stationery Office; *Palace of Industry* by C. R. Fay, The Syndics of the Cambridge University Press; *The Crystal Palace* by Patrick Beaver, Hugh Evelyn London; *The Story of Exhibitions* by Kenneth W. Luckhurst, The Studio Publications.

The Crystal Palace: Engineering or Architecture?



The Crystal Palace was the first truly significant building made of metal and glass. It was also the first building constructed with prefabricated, standardized units that were shipped to the site for rapid assembly—a practice now commonplace in many large construction projects.

TODAY the Crystal Palace holds a secure place in the history of both engineering and architecture, but whether it represented a triumph for either discipline was hotly debated in 1850. Although Paxton had been designing and overseeing the construction of parks, gardens, greenhouses, and conventional buildings for more than two decades, his lack of professional training in either discipline caused his plans to receive a cool reception. Distinguished members of the Institution of Civil Engineers prophesied the building's failure, and Paxton was never to receive the Royal Gold Medal in Architecture.

Victorian architects generally found the Crystal Palace lacking in a strong sense of form or organic integrity. They argued that Paxton's use of repeated modules was arbitrary and lacked artistic motivation or restraint. Indeed, there may be some validity to the criticism, for Paxton's first design was based on 20-foot modules. He increased the size to 24 feet only when he learned that this was the minimum width for an exhibitor's stall. And the overall length of the building was coincidentally and whimsically 1851 feet—the year of the exhibition, as Charles Dickens observed in his popular weekly, *Household Words*. But regardless of what professionals thought at the time, Paxton's Crystal Palace captured the hearts of London and the world in the mid-nineteenth century.

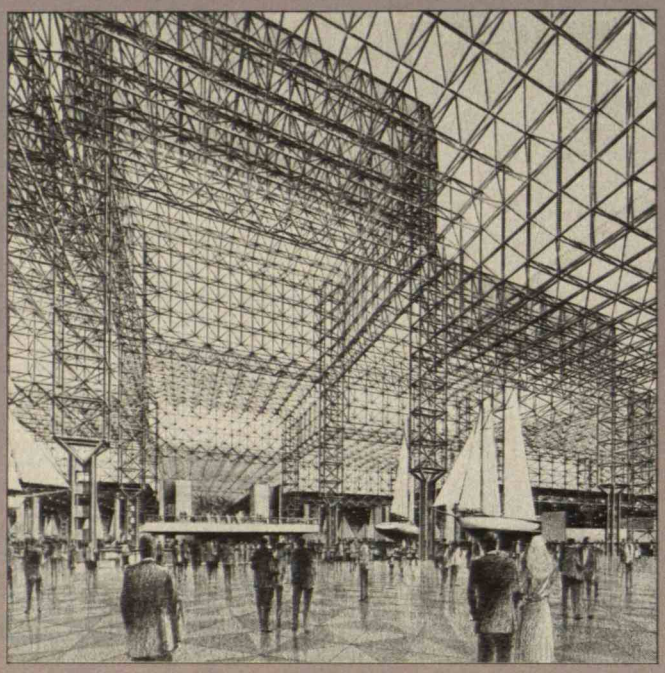
Because Paxton was not steeped in the traditions of engineering or architecture, he approached design problems without structural or artistic prejudice. He solved the problems of housing a giant water lily or a Great Exhibition alike with buildings that departed both from conventional methods of construction and rigid architectural traditions. In short, Paxton in his professional ignorance struck out in brilliant new directions that were to be models for the architects and engineers of the next century.

The Crystal Palace was the first large and truly significant building to be made of metal and glass, the first building to use outer walls that provided no structural strength, and the first constructed using prefabricated, standardized units that were shipped to the construction site for rapid assembly. These details are now commonplace in many large construction projects.

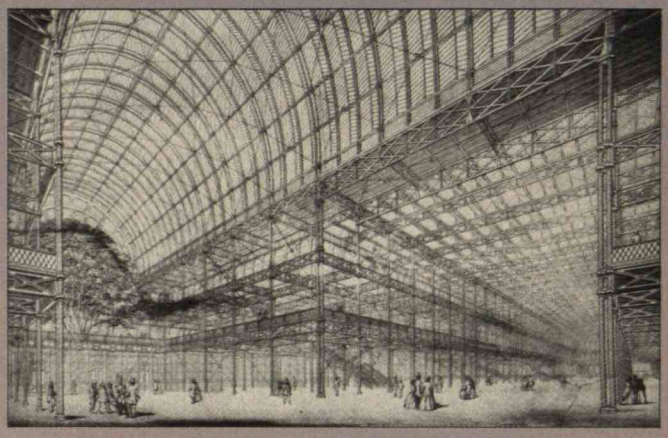
Among the architectural breakthroughs of the Crystal Palace was the building's use of colossal space. The repetition of structural units—enhanced by interior decorator Owen Jones's color scheme of "yellow rounds, blue hollows, and red flats"—was a clear forerunner of much of modern architecture.

Continued on page 28

Joseph Paxton's influence lives on. New York City's Exposition and Convention Center, designed by I. M. Pei and Partners and now under construction (below), was based on the Crystal Palace (below right).



The new IBM Garden Plaza Building on Madison Avenue follows the recent trend of including glass-enclosed atriums in urban buildings and recalls Paxton's glass-enclosed transept.



The building also stands, or stood, as a success story in construction management. Although built in what may seem to have been a simpler age, the Crystal Palace was not without many of the same complications that can delay modern construction projects and cause schedules to slip by years. The project involved major planning, financial, management, and labor components. The amount of materials that had to be ordered, manufactured, delivered, processed, and erected was enormous even by today's standards. And social and political obstacles existed as well, for although an environmental-impact statement was not required in 1850, Paxton still had to accommodate many objections.

As the roles of architects and engineers moved further and further apart in the later part of the century, the Crystal Palace served as a symbol of what could be but would not be again until the mid-twentieth century. Of course, conservatories and greenhouses continued to be built in the Paxton tradition. But for buildings designed to house solid institutions cultivating and preserving money, art, knowledge, and other relatively immortal commodities, heavy brick, stone, and cast-iron facades were the preferred style.

Perhaps the building's centennial contributed to its architectural reincarnation. Seemingly countless exhibits were staged and books published on the Crystal Palace in 1951, and Joseph Paxton and his building began to be favorably reappraised. In the 1950s Lever House and the Seagram Building, both characterized by the nonstructural "curtain" wall, rose in New York City to epitomize the concept of the tall glass box that has since become ubiquitous.

Indeed, Mies van der Rohe, who like Paxton had no formal architectural training, had actually anticipated in 1921 the multitude of successors to his Seagram Building with his then-unrealized "Glass Skyscraper," whose facade was reflected in its own curved forms. And his apartment buildings in Chicago, with their strong exterior structural details carried to an extreme—using steel beams and columns for purely decorative effects—helped to reawaken the sense of the technological roots of architecture implicit in the Crystal Palace. The ultimate example of this concept may be the exposed structural and mechanical elements of the glass-walled Centre d'Art et de Culture Georges-Pompidou in Paris.

The influence of the Crystal Palace is especially strong today, as architects include large atriums and open public spaces in their designs of corporate headquarters and other urban buildings. The new IBM building in New York has a four-story greenhouse, complete with bamboo trees green in winter, beneath its saw-toothed roof that cannot help but evoke Paxton's patented ridge-and-valley design.

But perhaps the most striking reincarnation of Paxton's building is the New York City Exposition and Convention Center now under construction near the Hudson River. Although the latest space-frame technology will be employed to support its roof of light-sensitive glass, the preliminary sketches for the building were based on the Crystal Palace itself.

The architects are I.M. Pei and Partners, and the partner in charge, James I. Freed, believes things have come full circle. Even today's problems of cost overruns and construction delays, though absent from the original Crystal Palace in Hyde Park, were prefigured in the re-erection of the building in Sydenham.—*Henry Petroski* □

PHOTOGRAPH: IBM

The Acoustic Detection

The Acoustic Detection

Scientists have studied microstructural discontinuities in high-carbon steel since the early 1920s. By monitoring acoustic emissions, a materials research engineer at the General Motors Research Laboratories has arrived at a more detailed understanding of how one type of discontinuity occurs.

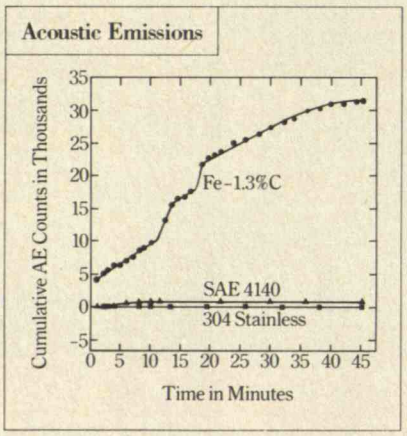


Figure 1: Cumulative acoustic emission counts for Fe-1.3%C steel, and control specimens of SAE 4140 and 304 stainless steel.

MARTENSITE is a hard microconstituent of steel which forms when austenite, iron containing carbon in solid solution, is quenched from a high temperature. The martensitic transformation produces steel that is hard and strong, but non-ductile. Through heat treatment, the steel can be tailored to applications requiring different degrees of ductility. High-carbon martensite—a highly stressed microstructure with a plate-like morphology—contains microscopic ruptures or separations 10 to 20 microns in length. These structural discontinuities, termed "microcracks," influence the mechanical properties of steel.

Although aspects of the microcracking phenomenon have been understood by metallurgists for more than fifty years, there is still no definitive explanation for when or how it occurs. An engineer at the General Motors Research Laboratories has devised an experiment that detects the microcracks as they occur.

The elastic energy released when microcracks form should produce a stress wave and associated high-frequency acoustic emission (AE). Using a piezoelectric transducer as the monitoring device, Dr. Michael Shea set out to determine what could be learned about the microcracking process by measuring AE.

The more widely accepted of two current hypotheses—the "impingement model"—asserts that microcracking is transformation-induced, taking place due to the collision of martensite plates during the quench. The other model maintains that microcracking occurs during the aging of martensite after the plates have already formed. The "aging model" suggests that thermal activation enables carbon atoms to rearrange themselves, producing localized stresses high enough to cause microcracking. Dr. Shea's ongoing research into high-carbon martensite led him to believe that the aging hypothesis was important. He proceeded to determine if AE is produced during aging.

For his study, Dr. Shea chose Fe-1.3%C steel, which undergoes martensitic transformation during quenching and is known to form

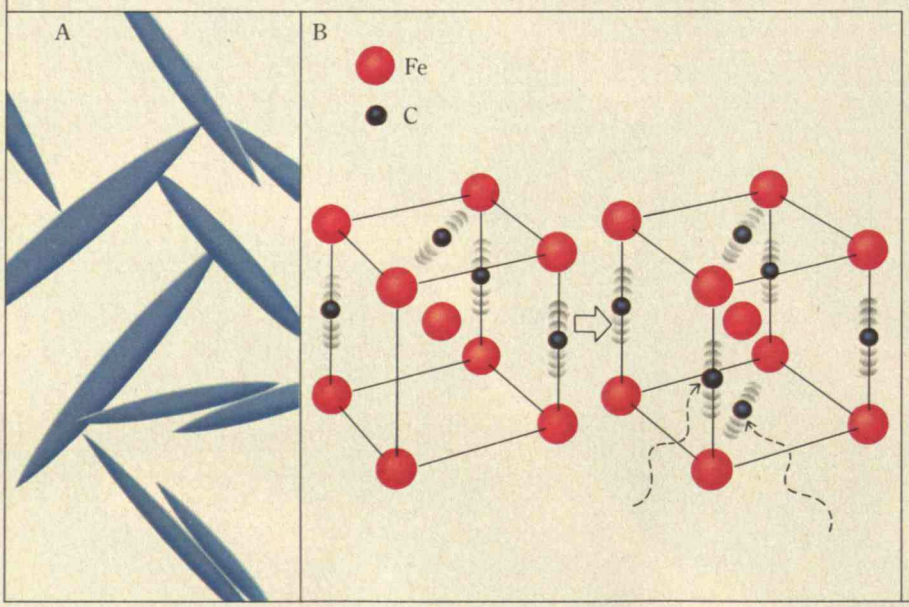


Figure 2: Artist's rendering of two proposed sources of microcracking: (A) impingement of the plates during the formation of martensite and (B) carbon atom rearrangement during the aging of martensite.

microcracks. To provide baseline data, control specimens of 304 stainless steel and SAE 4140 steel were put through the same procedures as the test composition. When quenched, 304 stainless steel produces no martensite, and SAE 4140 forms a low-carbon martensite which has a lath-type morphology, and generally does not microcrack.

SPECIMENS of the three compositions were quenched to -196°C and then slowly heated to room temperature. Acoustic measurements were made beginning at 0°C, at which point carbon atom mobility is sufficient to allow rearrangement processes to take place, and continued for 45 minutes after the specimens had reached room temperature. No AE was recorded for 304 stainless steel, and only a slight amount for SAE 4140. Significant emission, however, was measured for the Fe-1.3%C steel specimen during the entire testing period (see Figure 1). Since martensite had already formed during the quench, these results support the hypothesis that microcracking is produced during aging of the freshly-formed plates. Dr. Shea ruled out both slip and twinning as sources of AE since the literature indicates that neither factor is significant during aging of martensite below 40°C. The possibility that the AE resulted from isothermal transformation of austenite to martensite could also be excluded because this process does not take place in the composition studied.

"These results demonstrate conclusively," says Dr. Shea, "that microcracking occurs during the aging of high-carbon martensite, thereby providing support for the less accepted of the two models.

"The next challenge," he continues, "will be to quantify the relative contributions of both models—impingement and aging—in an effort to determine which, in fact, is the more important mechanism, thus furthering our understanding of microcrack formation. Then, perhaps, we can more systematically explore ways to minimize microcracking."

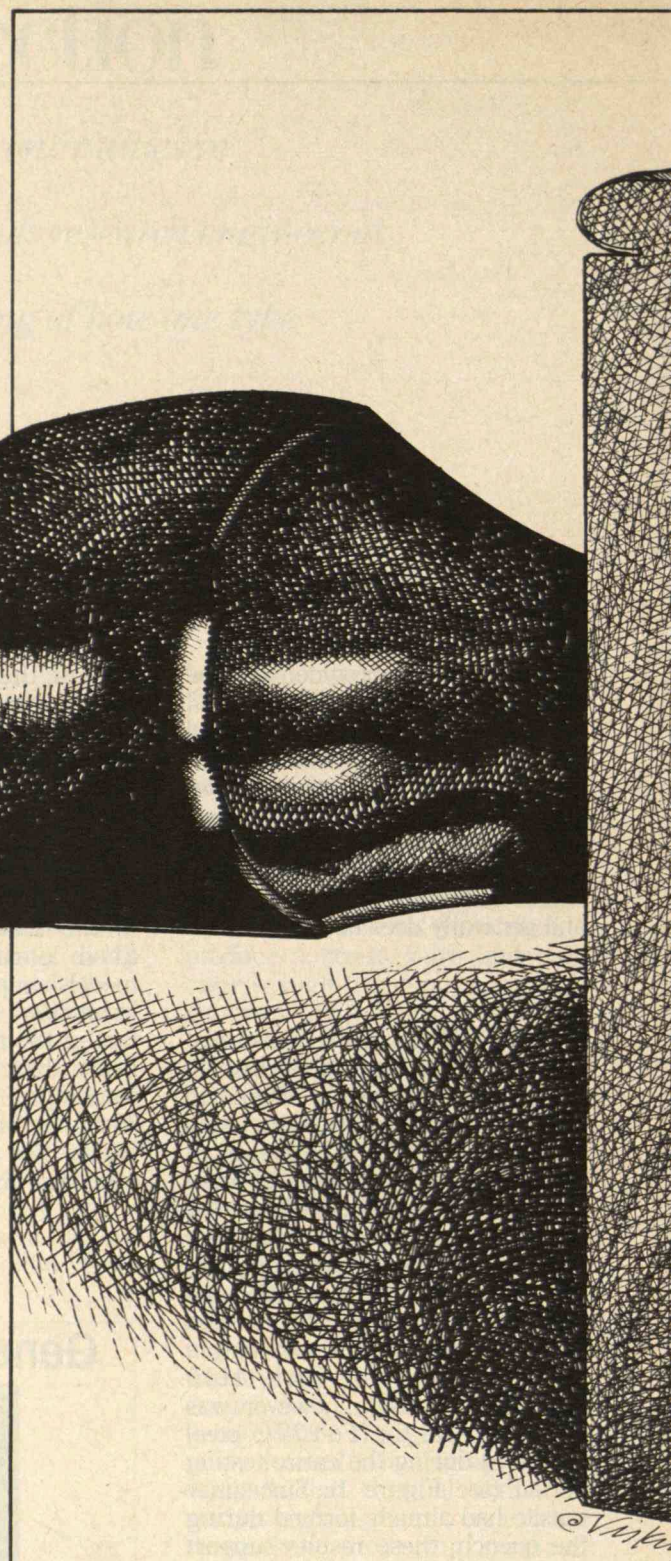
THE MAN BEHIND THE WORK

Dr. Michael Shea is a Staff Research Engineer in the Metallurgy Department at the General Motors Research Laboratories.

Dr. Shea received his undergraduate and graduate degrees in metallurgical engineering from Michigan Technological University, and his Ph.D. in materials engineering from Rensselaer Polytechnic Institute. His thesis concerned deformation and fracture of cesium chloride type superlattices. He joined General Motors in 1971.

The areas of metallurgical research pursued by Dr. Shea at General Motors include the mechanical properties of high-carbon steels, mechanically-induced transformation of austenite, and structure/property relationships in nodular cast iron. His exploration of the microcracking phenomenon in martensite was conducted with the help of instrumentation developed by GM colleague Dr. Douglas Harvey.

Will computers be used to make clerical jobs more tedious and bureaucracies more Byzantine, or to give workers responsibility and organize offices productively?



Office Automation and Bureaucracy

BY JONATHAN SCHLEFER

COMPUTERS seem almost to serve as a pernicious nutrient for bureaucracies, allowing their structures and their flaws to grow gigantic. "If you take a traditional bureaucracy and give it computers," says Paul A. Strassmann, vice-president of the Xerox Information Products Group, "then instead of generating 30 useless pieces of paper, you generate 300. You may be worse off." Michael Hammer, an office-automation consultant and associate professor of electrical engineering and computer science at M.I.T., simply says, "Automating a mess yields an automated mess." However, the problem is probably not the computers. Rather, in the electronic era, the age-old bureaucracy may be outmoded.

Of course, bureaucracies emerged over the course

ILLUSTRATIONS: GARY VISKUPIC


OTTO

of history for a reason. An amorphous group, in which everyone communicates with everyone, is feasible up to a point, but eventually work decreases. Too much communication and too little work produces a committee, in the perjorative sense of the word. A bureaucracy reduces the lines of communication by adding a ladder of command, with specialized tasks assigned to those on the lower rungs.

Unfortunately, other problems arise, both for workers and management. Workers' problems are clearer to see: bureaucratic jobs become tedious, and computerization can hone monotony to its practical limit. For example, Karen Nussbaum, the director of 9-to-5, the national association of working women, used to enter data into a computer terminal, along with about 200 others, on a vast floor at Hartford Insurance Co. in Boston. "I typed one green form all day long," she explains. "I had thousands of green forms. I typed the same series of symbols—codes, usually not even whole words—into the computer. I typed that in boxes at the top and then further on down. Nobody even told me what the point was."

Such boring jobs hardly make an organization effective. Instead, managers who attempt to use an office-automation system to routinize work often find that it "blows up in their faces," Michael Hammer told an office-automation conference last fall sponsored by 9-to-5. When work becomes too specialized mistakes proliferate; the bureaucracy spends increasing amounts of effort correcting them and coordinating fragmented units rather than doing anything productive.

The experience of Citibank in New York provides an example. During the sixties, Citibank's bureaucracy, well fortified by computers, was swelling rapidly. "At our peak of inefficiency," Richard J. Matteis, a senior vice-president, wrote in the *Harvard Business Review*, "Citibank operations starred a cast of thousands, [each person] handling only a part of the whole, a single task over and over again." An Opinion Research Corp. survey in 1970 rated the bank's customer service low, and at one point, Citibank had a backlog of 36,000 customer inquiries.

The solution offered by people such as Matteis, Strassmann, and Hammer is to replace the bureaucracy with more autonomous units. One could draw an analogy to the factory, where each worker typically does one operation over and over. However, some factory managers have begun to institute a team approach, in which, for example, a group of workers assembles an entire car. Similarly, a cohesive group in an office operation can become responsible for an entire—and meaningful—job rather than entering endless codes.

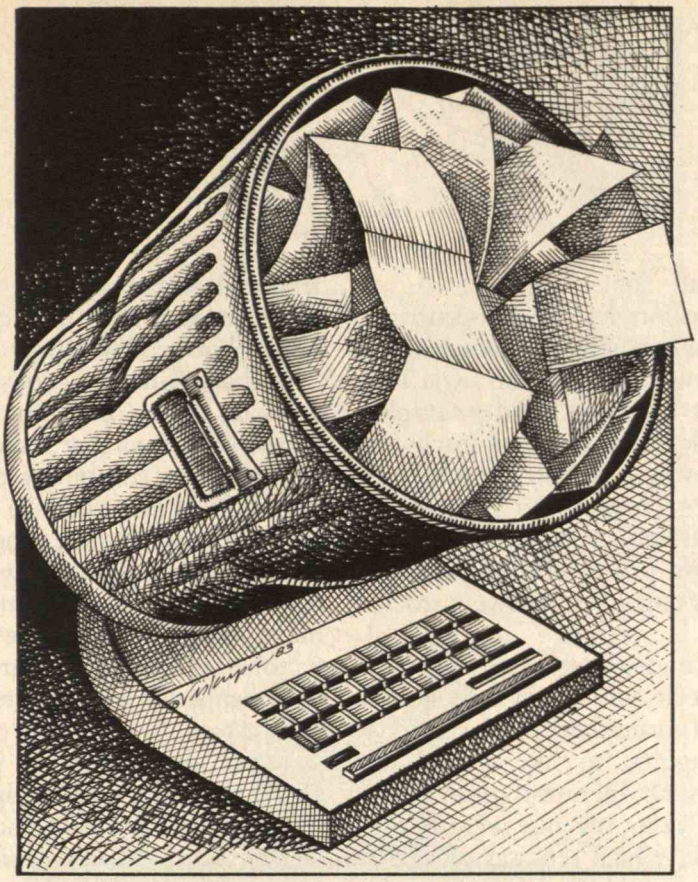
The hope is that by organizing offices better, managers in government and industry can reduce the legions of repetitive and menial jobs, invigorate an economy burdened by overhead, and eventually create positions with broader scope for the same workers. Society will be buoyed on a rising tide—if everything goes according to plan.

Bureaucracy Revamped

Citibank's "letter-of-credit" department is, within office-automation circles, a showcase example of a bureaucracy revamped. A letter of credit is a complicated promise from a bank that a customer's credit is good. For example, Citibank might give a letter of credit to a manufacturer in Lyons. With Citibank's guarantee to pay, the Lyons manufacturer could buy machine tools from a Michigan company. In 1975 Matteis, then in charge of the International Group's clerical operations, saw that letters of credit required many clerks, involved big sums, and offered great potential for error. A typical letter of credit was processed by 50-odd clerks in half a dozen units, who kept redundant files and sometimes used rubber stamps 10 years out of date.

On the twenty-fourth floor of the bank's Wall Street operations, a preprocessing clerk shunted the letter-of-credit request to the right issuance unit (there were several for different types of letters of credit). A log-in clerk logged it in, a preparer prepared it to be typed in standard form, a typist typed it, and a checker checked it. A marketing officer uptown approved the credit, a signature-control clerk okayed the signatures, and a second checker went over all that. Carbon copies were sent overseas, and a clerk from the unit that presided over the cabinets deposited another copy in the appropriate file. This might take 14 people three days.

But the letter-of-credit transaction had only begun. Quite likely the credit was paid out piecemeal: a $300,000 loan for machinery might be paid in $50,000 installments for six shipments. Each payment stirred the clerks of the payment unit into action. If one shipment happened to come in a $60,000 batch—such irregularities were routine—the whole letter had to be amended. The amendment unit did



Automating a mess yields an automated mess.

this. If something went wrong, no customer could presume to know whom to query, so customer service tried to figure that out.

Matteis decided the department was ripe for reorganization and concluded that this labyrinthine process could be done by one person. "At first there were no believers but my boss and I," says Robert A. Gottlieb, now a vice-president who was involved in the detailed reorganization in 1975. One clerk was expert in one aspect of issuance, another in one aspect of amendment. "In six months you can't take 20 years of my experience and teach it to everybody else," a clerk told Gottlieb. But by late 1976, one "work-station professional," as the former clerks were dubbed, was indeed able to complete an entire letter of credit, using a computer to call up the necessary information and file the results.

Though the computer helped tremendously, the reorganization would have been beneficial without it, Gottlieb says. Indeed, the clerks learned to carry out the new process on paper before any electronic equipment was brought in. Paul Strassmann, who works for Xerox, an office-automation vendor, also stresses that making offices effective is largely a matter of reorganizing rather than buying computers.

At Citibank, revamping the letter-of-credit operation benefited both the company and the workers. For them, doing the same task day in and day out had been "very monotonous," according to Betty Matos, a veteran amendment typist, payment typist, and amendment preparer. Before the change, clerks never knew how their work affected the overseas buyer or the seller in the United States, but afterward, they had the satisfaction of seeing the overall picture. Citibank surveys showed that soon after the reorganization, letter-of-credit processors were twice as satisfied with their jobs as standard clerks.

And there was better news ahead. While the letter-of-credit people were still learning their new jobs, they weren't given phone lines to customers, but when the phones were transferred over from customer service, the workers' satisfaction ratings doubled again. "The work-station professionals talked with the clients," Gottlieb says. "They answered the questions. The improvement became evident in little things like dress. The jeans disappeared and the skirts came in on the women, and the sweatshirts disappeared and the coats and ties came in on the men. Also, they were making more money." The average pay for an issuance clerk beforehand was $9,000, and today it is $15,000 to $18,000.

Management achieved a marked gain in efficiency: while 142 clerks had been required in the old letter-of-credit department, only 55 were able to do the same work after the reorganization. (The rest were transferred to other clerking jobs in Citibank.) Also, the structure of the office operation changed as the department's various subdivisions gained a measure of independence. No longer were letters of credit from around the world channeled from specialized unit to specialized unit in a production line. Instead, self-contained units transacted business for their own regions—Europe 1, Europe 2, Central and South America, Asia-Pacific, and the combination of Africa,

the Middle East, and India.

An analogous simplification has been occurring throughout Citibank, and when units gain autonomy, they become more entrepreneurial, Gottlieb says. The stock-transfer department offers a good example. Like other banks, Citibank keeps track of stocks of corporate customers. When a company's stocks are sold, Citibank cancels the previous owner's name and inserts the new owner's. Citibank also pays dividends for the companies, runs and proofs checks, replaces lost checks and stock certificates, and answers stockholders' questions.

Needless to say, in the mid-seventies this process was divided into many steps, and the whole stock-transfer department—well enmeshed in the bank's clerical operations—struggled to live within its allotted budget. As in any such operation, more business meant bad news. The extra revenue went to the marketing side of the bank, which sells services; the stock-transfer operation just had more work to do and a greater chance of overstepping its budget.

But the operation was reorganized so that individuals at work stations handled all the processing of stocks for particular companies, and units covered geographical areas. Managers saw their units' income and expenses and knew if they were making money: more business was good news. Retrieved from bureaucratic muck, stock transfer became a separate profit-and-loss center.

IBM's Grand Plan

Citibank's reorganization—and office automation in general—are not without problems. Details are hard to ferret out from behind corporate veils, but the overall picture is clear enough. Most importantly, although there are a number of instances where jobs are being improved and bureaucracies reduced in limited ways, academics and consultants are hard put to name major office-management reforms. Such reforms seem rare.

James C. Taylor is a researcher in a National Science Foundation (NSF) study of word-processor operators—the secretaries who type text into computers, make corrections and changes, and get printouts—in 200 organizations. He found clerical jobs that had become more professional: for example, clerks entering classified ads into a newspaper's computerized typesetting system helped customers phrase them. "I think clericals will be picking up professional responsibilities, and professionals will be doing some of their own clerical work," Taylor says. "But I know of relatively few cases so far."

Barbara Gutek, a consultant to the Rand Corp. working on an office-automation study also funded by the NSF, says that some professionals and managers are using computers to help them do their jobs better. But from what she could see, clericals can still look forward to increasingly fractionated jobs.

They can also look forward to reduced pay. In contrast to clerks in Citibank's letter-of-credit department, most workers in the highly automated financial sector have experienced an income drop. The salaries of nonsupervisory workers in finance, insurance, and real estate (which are combined in government statistics) declined by 10 percent in real terms from 1967 to 1980, according to U.S. Department of Labor statistics. Furthermore, according to the Labor Department's *National Survey of Professional, Administrative, Technical, and Clerical Pay*, 1982 wages for workers in these industries ranged from 7 to 25 percent below that of other U.S. clerical workers, depending on the particular job.

The rationale for partitioning work into specialized tasks is essentially to create an assembly line. In the sixties, IBM coined the phrase "word processing" and developed a word-processing plan that has become a notorious example of this logic. An article from the 1980 *McGraw Hill Yearbook of Science and Technology*, provided by IBM's public-relations department, describes the factory-like organization in an extreme form. Concentrating secretaries in "WP centers," according to the article, extends "manufacturing and production lines into the office. . . . This constitutes a move away from the traditional system in which the secretary reports directly to one or more principals [and] performs a full range of duties from typing to making travel plans." Instead, different tasks are allotted to different groups. "Correspondence secretaries" spend all day entering text into word processors. "Administrative secretaries" are given repetitive jobs "concentrating on specific office duties, such as answering the phone, scheduling, or making travel plans." Secretaries find "their work divided, specialization introduced, and their job status raised."

Though recent wage history makes that last point highly debatable, word-processing centers can be workable if managers take a moderate approach. Security Pacific National Bank in Los Angeles, for

example, runs a center in which the word-processor operators have a certain latitude. According to Judith McCullough, the director of the 9-to-5 chapter in Los Angeles, "They get to choose their next job—whether it is short or long, the particular person it comes from. Obviously you can't take a job that just came in when another has been sitting there a week, but the operators have some flexibility."

But R. A. Eliassen, a vice-president of Security Pacific, told *Business Week* in 1975 that when his bank tried to institute "the IBM grand plan" for word processing more to the letter, at least as it was then constituted, it just didn't work as promised. The plan merely concentrated the drudgery for some secretaries, giving others more time to run for coffee, said Eliassen, and a great many other managers and consultants have come to similar conclusions.

Fifty-five "work-station professionals" at computer terminals were able to do what had formerly required 142 clerks.

Big Brother and the Bureaucracy

Another problem is that bureaucracies seem to go hand-in-hand with a system of monitoring work, which is most obvious at the bottom of the ladder, and computers abet this process. Computers tabulate the amount of data, text, or transactions that clerical workers enter, and supervisors can scrutinize the error rate. Rosalyn L. Feldberg and Evelyn Nakano Glenn, assistant professors of sociology at Boston University, describe the perverse logic at work here: "The less management is willing to rely on workers' motivation, the more extraneous, regimented, and idiotic work has to become. The more extraneous, regimented and idiotic work becomes, the less management *can* rely upon the workers' motivation."

Claims processors at Equitable Life Assurance in Cincinnati—the people who approve insurance claims—are in just such a situation, according to Regina Canuso, the regional organizer for District 925 of the Service Employees International Union. The workers used to have more discretion in their work, she said. They spent some time answering questions on the phone, worked from paper forms to approve claims, did their own typing, and walked to the files from time to time. Now a separate group has been established to answer the phone, and there are no files to walk to. The approvers sit at their terminals and approve claims from typed forms all day.

These workers are riveted to their terminals "body and mind," Canuso says, and future pay raises depend on increasing production by up to 300 percent, while their error-free rate must not fall below 92.5 percent. Reports of their production can be printed out in the office and even at corporate headquarters in New York. "Imagine how you would feel if every time you put down your pen to stretch, the computer monitored you," says Canuso.

Equitable sees the system in a different light. Executives claim that some boring work has been eliminated: it is no longer necessary for data-entry clerks to take the paper forms prepared by the claims processors and punch them into the computer. "I don't think anybody looked on rummaging through files as an advantage," says vice-president Scott Bryer. The 92.5 percent error-free rate has been

around for a decade, and the terminals save the operators from having to do as many calculations. Approvers used to do about 20 claims a day. Today the production rates vary from 35 work units—a measure that approximately equals a claim—to 92, with an average of 43. Pay varies according to work and accuracy. "You are going to spend more time doing what you are supposed to if you know you will get bigger bucks for it," says executive assistant Len Negley.

Monitoring and excessively enforced work rates can take a toll on workers' general well-being. In what is known as the "San Francisco Study," published in 1981, the National Institute for Occupational Safety and Health (NIOSH) compared clericals who worked on video display tubes (VDTs), clericals who did not work on VDTs, and professionals who worked on VDTs. The professionals—newspaper reporters who found satisfaction in their work and had flexibility in how to meet deadlines—experienced the least stress. The clericals who did not have VDT screens were under more stress. The clericals who did work on VDTs had "very little" control over their tasks, found "little satisfaction" in their work, and felt the most stress. Indeed, they experienced higher stress than any other group NIOSH has studied, including air-traffic controllers, according to Harley Shaiken, a researcher in M.I.T.'s Science, Technology, and Society Program.

Monitoring is one of the charges leveled against Citibank's letter-of-credit operation: the computer tells the manager how many letters of credit people at work stations complete. "If people are work-station professionals, then why do they have to be monitored?" says Leslie Schneider, a research associate at the Harvard Business School who has studied office automation.

Citibank's Gottlieb says that quotas for letters of credit—which take into account the different complexities of different letters—are not used to crank up work rates but rather as reasonable guides. "We haven't pushed productivity, but we do need to measure it to know what we are up against." Betty Matos, who used to process letters of credit and is now a manager, agrees and says the tabulations are used to balance work loads.

Monitoring aside, some critics question whether individuals who work alone at computers can have much room to grow in their jobs or share much in the purposes of a larger office group. Feldberg and Glenn, the Boston University sociologists, suggest an alternative somewhat like the team approach in manufacturing. They describe a payroll office at a college that operates informally almost as an independent subcontractor. (In established sociological tradition, they do not wish to name the college and thereby identify their informants.) The "contract" is that, come what may, the workers must get the payrolls out on time. But within that framework they apportion work among themselves. One spends a timely hour at a museum; another has her granddaughter visit for a day. And because of the freedom they enjoy, they are motivated to get the payroll out. When questions arise because a professor is new, another has been on leave, or a third has done special work, they track down the answers they need to get out the checks on time.

Democratic Automation

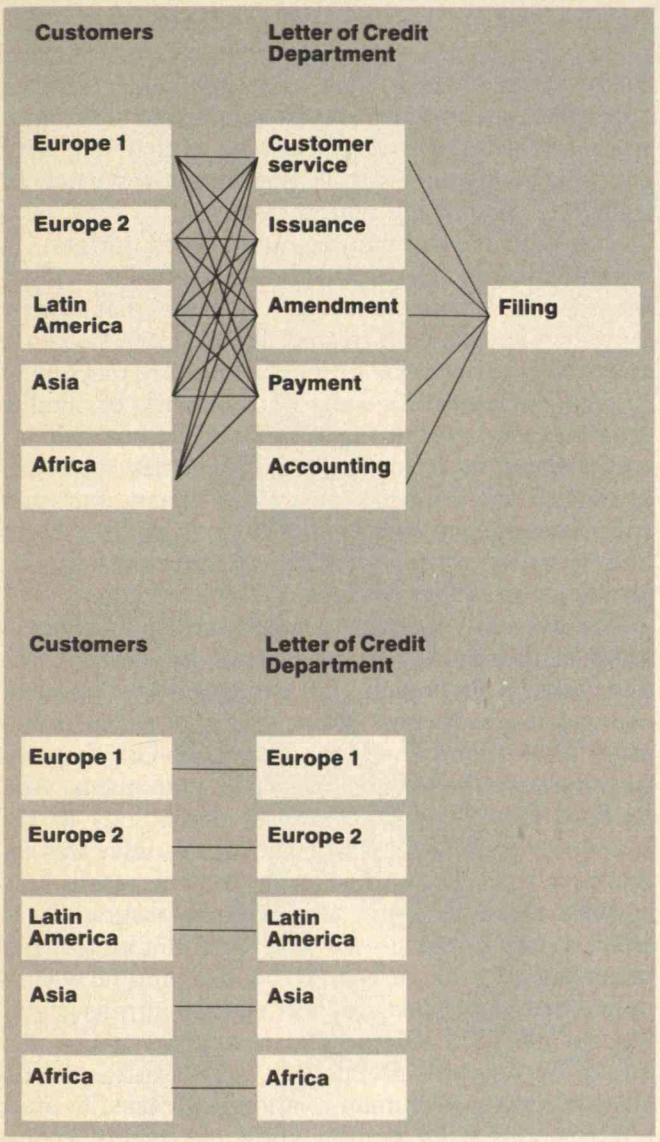
How should one go about automating offices? A small group of managers and secretaries make better decisions about office organization than office-automation experts, says Richard Barry, administrative operations coordinator at the World Bank in Washington.

Barry was charged with planning a word-processing system for the Eastern Africa group, composed of about 300 people from many countries. The group assesses the needs of developing countries with a view to making loans—for a road, a hydroelectric dam, an agricultural program—and then assesses how the projects are progressing as loan installments are paid. Staff members go to Africa periodically and write report after report, which members of the board of executive directors use to decide on new loans and assess ongoing projects.

Hence the need for word processors. Barry originally envisioned a small word-processing center supplemented by individual machines in offices. But rather than implementing this plan by fiat, he convened a task force of a dozen professionals and secretaries. The group's efforts were not always smooth; for example, it was not always easy for female U.S. secretaries to confront professional men from the male-dominated societies of some developing countries.

But the group did reach a decision—to avoid having a word-processing center. Just about every time you turn around in the Eastern Africa group, some-

Clericals working at computer screens experienced higher stress than any other group, including air-traffic controllers.



Communication became simpler when Citibank's letter-of-credit department was reorganized and automated. Beforehand (top), each letter of credit — a complex guarantee to extend credit to a corporate customer — went through the department assembly-line fashion. Accounting kept the books, filing kept other records, and customer service helped customers figure out whom to deal with when. After the reorganization (below), an individual at a computer processed an entire letter of credit for a customer, and units dealt with their own geographical regions.

thing has to be typed, and the professionals did not want to have to live with a first-in-first-out system. "Somebody else gets there first," Barry explained, "so that project gets out first even though yours is more important."

Some secretaries, concerned about reports of harmful effects of VDTs, did not want to work on word processors eight hours a day. If they were chosen for the pool, would they have to decide between that and losing their jobs? The secretaries were also afraid that even if they were *not* in the word-processing pool, they would still lose contact with the work of their department. For example, before the installation of word processors, suppose figures for one of those ubiquitous reports were to arrive from Mr. Taha, a Sudanese economist. A secretary who typed the report and left blanks for the figures would know who Taha was when he called. However, if the report were typed by the word-processing pool, the secretary probably would not.

Everybody agreed that once a word-processing center was established—with a manager and staff—eliminating it would be near impossible, so the group did not want one even in incipient form. As a result, all the word processors are now distributed among the offices.

The office-automation task force also decided that the secretaries should be given more professional-level work, such as compiling statistics. Unfortunately, that idea was "totally dropped" in practice, Leslie Schneider, a consultant to the World Bank, reported to a workshop at the 9-to-5 conference. "I think the managers have not had enough education about this." Barry, who left the Eastern Africa group to plan automation elsewhere when the word processors arrived in 1980, agrees that less professional work has been delegated than he would have liked.

White-Collar Detroit?

One of the biggest concerns with computerization is whether there will be enough jobs left to go around. Even projecting current trends—without accounting for broadscale revamping of office structures—many observers are pessimistic. Karen Nussbaum, expressing the viewpoint of 9-to-5, estimates that 20 million U.S. office jobs will be jeopardized by automation. At the 9-to-5 conference Robyn Dasey, a research officer at the Banking, Insurance, and Finance Union in Great Britain, said that after remaining stable for several years, employment levels at the major banks were dropping: "Last year the Midland Bank, one of the big four in Britain, declared 2,000 redundancies." For those in the audience unfamiliar with British

DIAGRAM: OMNIGRAPHICS

lingo, she added, "A redundancy means you're sacked."

Middle managers' jobs are threatened as well. With the introduction of automated tellers, fewer branch managers are needed. "Last April Midland shed 140 branch managers," Dasey explained. In England it is common for manager trainees to get experience in a number of departments until they become "qualified bankers" and finally branch managers. "If you have 140 fewer branch managers among 500 branches, these people don't have jobs, and the ones below them are also stuck looking nowhere. The chain effect continues down the line: 2,500 potential promotions are out the window."

Others say that with automation, jobs can be made not only better but more numerous. For example, Paul Strassmann at Xerox sees the problems of our economy as being caused by burdensome overhead. "In engineering and design departments of corporations, you're lucky if people spend 20 percent of their time on technology. They spend most of their time in meetings—progress meetings, budget meetings. Society is vastly unproductive administratively. That's a prime cause of inflation. But we are going to fix this. We are going to really go after administrative overhead, lower prices, increase demand, and become competitive."

The ability of U.S. business to do more with less overhead can produce a surge in wealth and 20 million new jobs by the end of the century, Strassmann believes. The Industrial Revolution, after all, did not mean that fewer factory workers made the same number of shirts, bathtubs, and vehicles as craftspeople formerly had. Rather, increasing numbers of workers turned out more goods than ever before.

Whatever the future holds, few argue that the United States should face it with increasingly centralized bureaucracies and fragmented jobs. "All the evidence suggests that alternatives work better," says M. Lynne Markus, a consultant at Arthur D. Little, Inc., and an assistant professor on leave from M.I.T.'s Sloan School of Management. But alternatives require profound structural changes in organizations, as Citibank discovered. "If you start with specialization at the top," says Markus, "there isn't much you can do at the bottom, because you realize that half of what should be one person's job is in another division. Reorganization is a painful process, and few organizations have the vision to do it."

With the economy in the doldrums, it should be no surprise if managers seek short-term answers. "Planning has been done quarter by quarter," Richard Barry at the World Bank says. Managers' general failure to look beyond specialization and centralization may be "just another example of that. We went through it with the assembly line, and now we may be doing the same thing with secretaries."

The parallel to manufacturing goes further. In manufacturing, after an inordinate interval of neglect, the idea is beginning to gain respect that hourly workers shouldn't be treated as automata but have valuable contributions to make. They are meeting in quality circles to do some of the work of quality engineers—work that these engineers had trouble accomplishing in isolation. Quality circles were imported to the United States from Japan, but they weren't conceived of there—they grew out of what is known as the "human-relations" movement in U.S. sociology and psychology earlier this century.

For example, in a landmark study published in 1948 in the journal *Human Relations*, Lester Coch and John R.P. French, Jr., examined the frequent changes in production setups in a U.S. garment factory. They found that such changes went dramatically better when workers helped plan them. And Richard Barthol, a professor of psychology at the University of California at Los Angeles who was involved in the human-relations movement, recalls how he tried to implement a "zero-defects program"—in effect a quality circle—for a defense contractor. But management was not behind the idea, and he was finally fired; his colleagues met similar intransigence. Meanwhile, in 1947 the Japanese government had asked W. Edwards Deming, a U.S. statistician who believed firmly in human-relations concepts, to start implementing what are now known as quality circles. In Japan, of course, these prospered.

Unfortunately, U.S. office managers today may be paying as little attention to these ideas as factory managers once did. "In the absence of more enlightened thinking," says Barbara Gutek, an associate professor of psychology at Claremont Graduate School working on the Rand office-automation study, "managers will maintain control and make workers as expendable as possible. If so, there is going to be trouble." Workers, managers, and society will surely fare better under an approach that creates whole jobs and keeps workers motivated.

JONATHAN SCHLEFER is a senior editor of Technology Review.

Skydivers descend into Briggs Field to the delight of spring weekend participants on a sunny Saturday afternoon. Their mission: to begin a skydiving club at M.I.T. under the tutelage of Northeastern University club members. (Photo: James J. Snyder)

Cookies, Woes, and "How Well Do You Write?"

The atmosphere was carefuly made as light as possible for the 60-minute exam: chocolate chip and sugar cookies adorned round tables in the du Pont Gymnasium (chocolate chip was the easy favorite). Professor Kenneth Manning, chairman of the Committee on the Writing Requirement, gave students a few words of advice: "Take 20 minutes to organize and 40 minutes to write."

A writing requirement was passed by the faculty to be officially instated in September 1983, when M.I.T. will require all students to show writing proficiency before they graduate. The ways to achieve this end are flexible; each student can choose from a range of options to construct the most appropriate and valuable course of action for his or her needs. Last fall's freshman class (of '86) was invited to take the exam as an experiment—to provide an assessment of students' writing ability and help the committee evaluate the writing needs of incoming students. Though freshmen were invited, not required, to take the writing essay test, they were "strongly urged," explains Bonnie Walters, coordinator of the program. Out of 1,100 freshmen, 971 took the exam.

After a week of orientation spent bouncing around to different fraternities and dorms, trying to decide where to live, a few of the freshmen were restless. Although most were serious, ten students around one table responded with great fervor to the friendliness, inspiring each other to new heights of silliness, writing upside down, including drawings and poetry, fashioning paper airplanes from scratch paper, but not the exam paper.

The test: take one hour to write an essay on either of two topics: "Evaluate your Residence/Orientation experience of the last week, discussing its strengths and weaknesses. How would you change it?" (the popular choice) or "Describe a scientific experiment that you have performed or read about and that was of special interest to you. Why was it important?"

The essays were turned over to evaluators—faculty and staff from throughout the Institute, including President Paul E. Gray, '54. They looked for good organization and sentence structure, appropriate vocabulary, and correct punctuation and spelling. Evaluators were given guidelines to indicate strong and weak points and were expected to comment on each essay. (The R/O Week essays were also used to gain insight into students' perceptions of rushing and orientation week by the Undergraduate Association.)

Varied Alternatives to Choose

Students received from their evaluators one of three messages:

☐ The essay does *not* satisfy phase I of the writing requirement (and these students were given an appointment with Bonnie Walters to discuss the essay and means to improve their writing skills).

☐ The essay satisfies the requirement but skills could be strengthened and Ms. Walters would advise them.

☐ The essay meets phase I of the writing requirement (which should be completed by the end of freshman year), and nothing need be done until time for phase II.

Beginning this fall when the writing requirement becomes official, there will be three other ways to satisfy phase I: a score of 750 or above on the College Board Achievement Test in English Composition with essay; a passing grade in any of a number of expository writing subjects to be taken during the freshman year; or submitting a five-page paper of expository prose (written for any M.I.T. subject during the freshman year) that is

Laurie Blackwelder, '86 (bottom) and her sister, Shelly, display their balancing abilities on a unicycle. (Photo: P. Paul Hsu, from The Tech*)*
Opposite page: students elect to take a writing exam as part of M.I.T.'s new writing requirement. (Photo: Calvin Campbell)

judged satisfactory by the professor in charge of the subject, and by a faculty evaluator for the writing requirement.

To satisfy phase II (which should be completed by the end of the junior year) every undergraduate must receive a grade of B or better for writing in a subject in the student's professional field, or in an advanced subject in scientific and engineering writing. (Students may also choose to submit a ten-page paper of expository prose from any M.I.T. subject or UROP activity.) Through all these processes, students are encouraged to take advantage of the Writing Program and the Writing and Communication Center's individual consultation and frequent sessions on writing problems, or subjects in the writing program. Phase II is meant to inspire the students with a sense that they must try to improve their writing ability throughout their years at M.I.T., and throughout their lives.

A Technique to Learn

"Alumnni have told us of the need to write well in the business world—and one thing they mention is that they wish they had writing instruction during school," explains Professor Manning. "Students are enthusiastic—they see writing as a technique, and they're intrigued to learn how to do it well," he added.

One student letter in the Boston *Globe* commended M.I.T. for its concern: "Even if many of us do not realize it, our advanced communication system is one of man's greatest advantages. Just about every household has a television, a radio, and a telephone," wrote Grace Tan, '86. "But one of the oldest (and probably best) systems is still the written form. Written records are permanent. Thus, it is too bad to see that while technology is taking such a great stride forward, writing may be sneaking a small step backward. The College Board and other national surveys have assured us that the quality of writing is declining steadily. I, for one, am glad to see M.I.T. launch its new writing requirement with so much force and effort. . ."—*M.L.*

Not too comfortable, perhaps, but definitely original seating. (Photo: Francesco Floris from The Tech*)*

Gray: Four Issues Before M.I.T. in the Coming Decade

By Robert M. Byers

President Paul E. Gray, '54, in a far-reaching review of the university's future during the next decade or so, told a meeting of the faculty early this spring that M.I.T. through the 1980s will face stern tests in four generally related areas of academic life—the mission and character of its undergraduate education, the ultimate size and scale of operations, the scope and range of its intellectual enterprise, and the cost of doing research here.

Need for Institutional Vision

"This special place has a remarkable ability to sense the needs of the future and to get there first; indeed, to have a large hand in shaping the future," President Gray said. "My principal task here is to enhance the academic and social environment in ways that will encourage the extraordinary individuals who comprise this faculty to follow their intellectual instincts. It is a role of nurturing and supporting a congenial environment.

"At the same time, however, there is a need to reexamine and to reconstruct for these times the larger framework of the Institute—to articulate questions and encourage answers which will help us decide what we may be and where we should go."

Undergraduate Mission

Issues the university will be required to settle over the coming decade in the field of undergraduate education, the president said, have to do with "who studies here"—issues of preparation, cost, access and diversity—and "what is studied here"—the proper balance between an early start on a professional career and more general educational goals concerned with "the liberal components—humanistic, scientific and social—of undergraduate studies."

"We need to come to some consensus of what that balance should be," he said, "because that balance has first-order consequences for curriculum structure, for pace, for patterns of enrollment, and for the general campus climate."

Size and Scale of 1980s

Issues of size and scale—of the student body, of the faculty, of the research enterprise—also will be of continuing concern as M.I.T. moves through the 1980s, the president said.

Student body growth in the 1970s was partially driven by budget needs, he noted. But in the 1980s, he said, M.I.T. will need to decide what its "right size" ought to be.

Likewise, the scale of research will be an issue for the university and this will be influenced by shifting needs of sponsors, by the desire to couple research to education, and by the role that special-purpose laboratories (such as Lincoln Laboratory with a single sponsor and a particular focus) might play in M.I.T.'s future.

Size and scale issues, President Gray said, will place a particular premium in the 1980s on strategic planning in undergraduate admissions and on academic planning processes. One issue that clearly will need rethinking, he said, is admission of transfer students to upper classes, something the Institute—unlike its peer institutions elsewhere—has not emphasized or sought in years past.

Intellectual Scope

M.I.T., President Gray said, is especially well prepared to grapple with the larger problems associated with the third area of concern—what should be the scope and range of the university's intellectual enterprise. M.I.T. has a strong tradition, he noted, of engaging and shaping questions that affect disciplines and relations between disciplines and this tradition will be a source of strength in examining future intellectual range. So, too, will be M.I.T.'s tradition of a single faculty and its 35 years of evolving interdisciplinary degree programs.

"In the coming years, we must become better at applying critical judgments to each domain of the intellectual enterprise," he said. "Our ability to redirect our resources will be crucial to our ability to undertake new ventures and to bring about change."

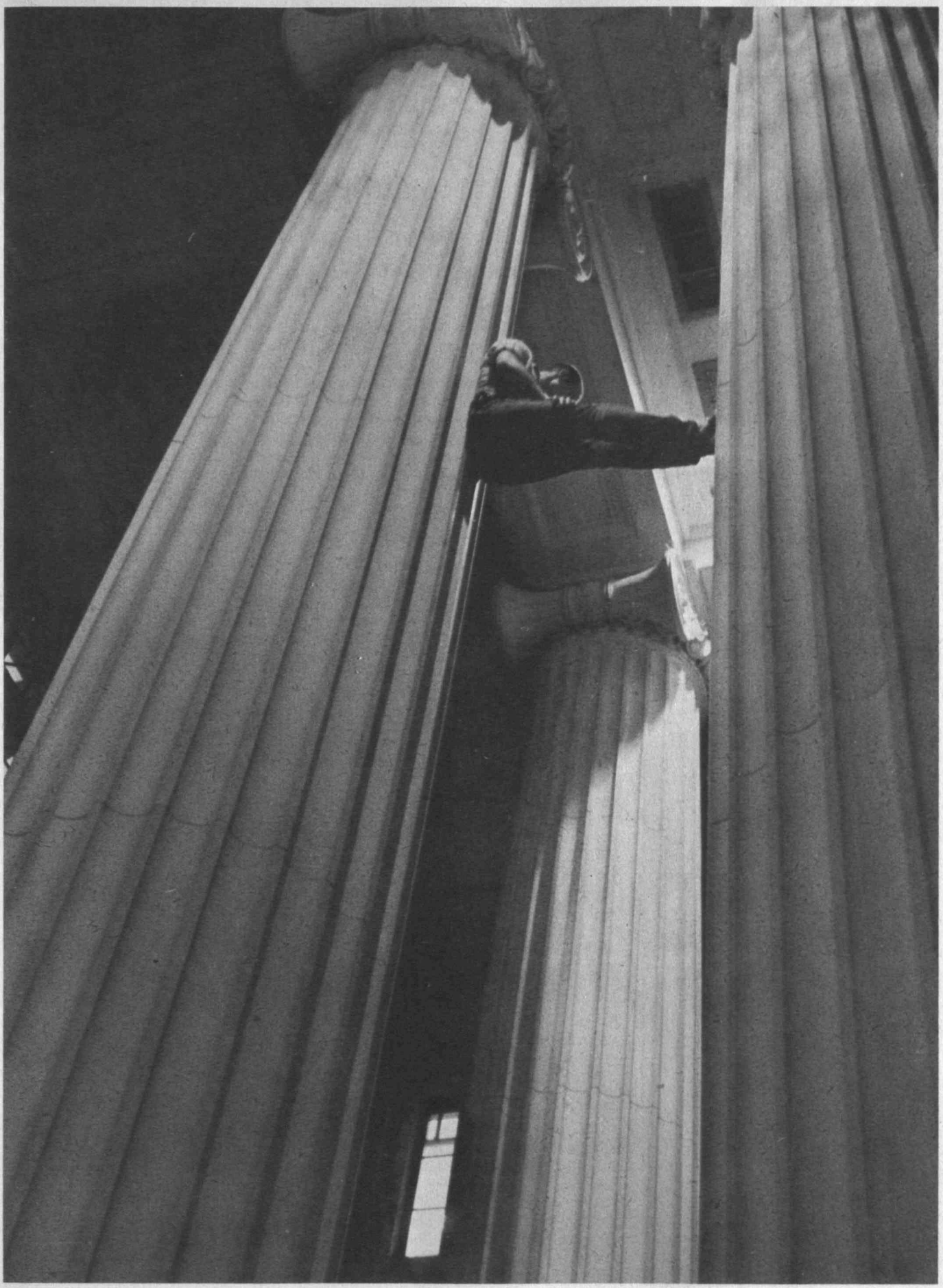
Research Competition and Cost

Cost of research, President Gray said, is emerging more strongly than ever as one of M.I.T.'s most crucial issues for the 1980s.

Research is at the heart of the faculty member's life here," he said. "It is the matrix which sustains and informs our academic programs. The quality of the faculty has consistently attracted research support despite constraints on funding."

But competition from peer institutions, he said, is becoming more intense than ever before, and the high cost of research at M.I.T. when compared by sponsors to costs at peer institutions is a growing concern.

Efforts already are underway, he noted, to check M.I.T. costs—i.e., a three-year effort to reduce administrative and support budgets by as much as 15 percent. Consideration will also be given to ways in which the research administration at departmental, laboratory and center levels might be reorganized or reduced. But despite these efforts, he said, the cost of doing research at M.I.T., while by no means out of control as some have suggested to him, is high and promises to continue that way.



Too Much Was Too Much

"Higher level programming languages" are the subject of the course in Computer Language Engineering (6.035) for sophomores in electrical engineering.

But this year the level was just too high, and no resolution of the M.I.T. faculty (see right) was required to persuade Professor John V. Guttag to lighten the load on his students as the spring term ended. In the final weeks of the term, Professor Guttag reduced lectures and recitations from two to one hours each, cancelled the final part of a class project, and extended the deadline for one out-of-class assignment—all on the basis of student complaints whose validity he accepted.

"The course was simply too time-consuming," Professor Guttag told Ron Norman, '86, of *The Tech*. "It took more time than I anticipated." One reason, said Guttag, is that the students were generating too much work for the computers; the computers were simply too slow to handle the load.

It was the first year Guttag had taught the course at M.I.T., and he says the department "will smooth the rough edges" before next fall.

Excessive Pace Can Be "Detrimental to Performance and Learning," C.E.P. Finds

End of the term. The image often conjured up is one of stress, when litanies of "Too much work, too little time!", "How can I get good grades?" (the specter of a huge F floating in the distance), "I need more sleep," and "Help!" vie for a larger piece of the mental pie called anxiety (or mincemeat).

M.I.T. is particularly known for pace and pressure. But what happens when this ever-present state peaks at the end of the term?

During the last week of classes last fall, the Committee on Educational Policy sought some answers with a questionnaire mailed to randomly selected students. Students were asked to assess the pace and pressure at the end of the term using a five-point scale ranging from "okay" to "intolerable." They also were asked what effect, if any, the pace had on their performance. The five-point scale ranged from "positive" to "extremely adverse." They were to indicate any exercises (quizzes, exams, papers, take-home exams) that were particularly stressful and construct a calendar showing when different assignments were due during the last three weeks of the term (which included finals week).

With a 70 percent response from undergraduates and first- and second-year graduate students, the C.E.P. concludes that the pace at the end of the term *is* in fact excessive for many students. The pressure, said the committee, "can be detrimental to performance and learning, and thus constitutes a significant problem." For freshmen, however, the pace and pressure at the end of the term "does not appear to be excessive, an important positive consequence of freshman pass/fail."

About 40 percent of upperclass students and 25 to 30 percent of the first- and second-year graduate students assessed the pace as worse than "too hectic." A similar proportion felt that the pressure had an adverse or extremely adverse effect on their performance.

"Only a negligible percentage of both undergraduates and graduate students spontaneously characterized the pace as 'a fact of life at M.I.T.'—that teaching students to work under great stress is a positive attribute of M.I.T.," the committee reported.

Thirty-five percent of upperclass students in the survey received extensions on some deadlines for turning in work, showing that this is "an important mechanism for many students in coping with the pace and pressure," according to the report.

Personal Observations

Statistics aside, some comments illuminate the inner workings of the frantic student beset by a sense of overwhelm:

"These profs are crazy!! I'm going to die."

"The week of 11/29 I only got a total of nine hours sleep; it was very hard and adversely affected my exam on 12/2 since I had pulled two all nighters in a row."

"No comment—I have to get to work."

"The pace is harming my health. Long hours and hard work cannot be maintained for two-plus weeks."

"It is not so much the pace but the pressure to excel. My final papers theoretically reflect the sum of my academic achievement this term."

"I hardly get any sleep, and when I try to sleep I can't; I haven't been able to have a meal with my wife and baby in a week."

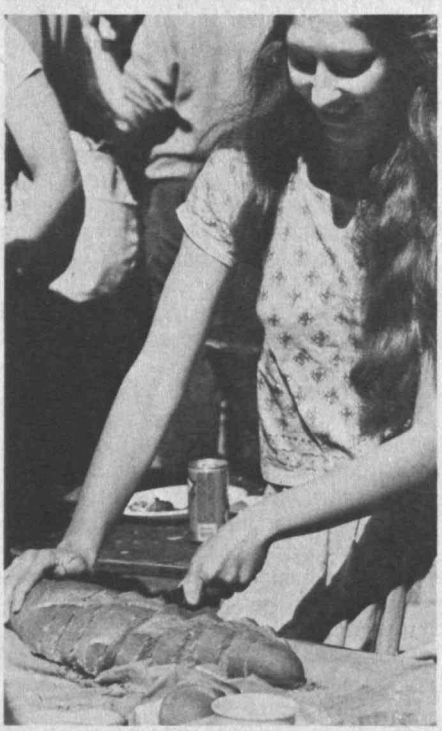
"The end of the term is really intolerable. I have not been sleeping for more than three hours each night. The most important and the most complicated topics of each course are presented at the end of the term; the lectures get to be too fast and the quantity of the assignments becomes double."

"I'm very near to a nervous breakdown."

Spreading the Load

Given the difficulties, what are the solutions? Some student suggestions of ways to improve the end of the term: Even out the pace of exams and papers throughout the term by assigning more work at the beginning and by "covering less material in total." Lengthen the (two-day) reading period to allow more time to study for exams. Limit the amount or kind of assignments that can fall due at a particular time, especially during the last week of classes. Students felt that the last week of classes was particularly stressful because they often are expected to complete papers, lab reports, and projects, while at the same time prepare for final quizzes that week and/or final exams the next week—all of which count a great deal in the final grade.

Some specific suggestions "Do not allow graded problem sets to be due the last week; do not allow both a final project and a final exam in a subject; do not allow assignments of any kind to be due the last week of classes; end classes a week earlier; do not allow final quizzes (in subjects with finals) in the week before the last week of classes; do not allow any new material to be covered in the last week of classes . . ."—*M.L.*



Spring weekend: a time for outdoor eating, racing with legs tied to other legs, music, skydiving demonstrations; a hiatus from studies. (Photos: James J. Snyder)

Under The Domes

R. W. Mann

E. M. Bevington

R. S. Borovoy

J. T. Coe

D. E. Gushee

M. H. Kaericher

C. V. Vappi

Professor Mann Leads Alumni Officer Slate of 1983-84

Robert W. Mann, '50, Whitaker Professor of Biomedical Engineering in the Department of Mechanical Engineering at M.I.T., is now leading the Alumni Association as its president in 1983-84, taking office at the close of business on Technology Day, June 10.

Professor Mann is one of eight new officers of the Association chosen by the 1983 Selection Committee early this year. The others:

☐ **E. Milton Bevington,** '49, vice-president for three years. After extensive industrial experience with Dewey and Almy, Westinghouse, and the Trane Co., Bevington organized Servidyne, Inc., an energy management company, in 1974, and he continues as its president with headquarters in Atlanta, Ga. Mr. Bevington studied chemical engineering at M.I.T., where he was a member of Sigma Alpha Epsilon; he also holds an M.B.A. from Harvard.

☐ **Roger S. Borovoy,** '56, director for three years. Borovoy is vice-president, general counsel, and secretary of Intel Corp., Santa Clara, Calif.; he previously held positions as a patent attorney and in legal practice in the San Francisco area. Following his M.I.T. degrees in chemical engineering, electrical engineering, and management, Borovoy studied at Harvard Law School (J.D. 1959), and he was admitted to the California bar in 1961.

☐ **Jerome T. Coe,** '42, director for three years. Mr. Coe is recently retired after a 40-year career with General Electric in many assignments and several locations, culminating as head of the man-made diamond and magnet businesses. Coe studied chemical engineering at M.I.T.; he now resides in Greenwich, Conn., and in retirement is teaching and consulting on a part-time basis.

☐ **Raymond H. Danon,** '58, vice-president for two years. Mr. Danon entered M.I.T. as a foreign student from Mexico, and upon graduation in chemical engineering he returned to Mexico to work with Procter and Gamble in Mexico City. He is now associated with Novaquim, S.A., Mexico City, a manufacturer of rubber chemicals, intermediates, and specialty organic compounds. Mr. Danon is a past president of the M.I.T. Club of Mexico, and he's an active member of the National Association of the Chemical Industry of Mexico.

☐ **David E. Gushee,** '50, director for three years. Mr. Gushee is chief of the Environment and Natural Resources Policy Division of the Congressional Research Service in the Library of Congress. He began his chemical engineering career with the du Pont Co. and was for 16 years with the American Chemical Society as an editor for *Chemical and Engineering News* and later editor and publisher of *Industrial and Engineering Chemistry*.

☐ **Michael H. Kaericher,** '62, director for three years. Except for two years of Army service in 1963-65 and two years at Carnegie Mellon University as a graduate student and research assistant in industrial administration, Mr. Kaericher has been in financial management with the Ford Motor Co. ever since graduating from the Institute; he is now financial controls manager on the world headquarters staff in Detroit.

☐ **C. Vincent Vappi,** '48, vice-president for three years. Mr. Vappi is president and treasurer of Vappi and Co., Inc., a construction firm with headquarters in Cambridge, Mass., with which he has been associated throughout his business career. Mr. Vappi's M.I.T. degree is in the field of building engineering and construction, and he started with the company immediately upon graduation. Mr. Vappi is also active in a wide range of community affairs in the Boston area.

Professor Mann, who will be president of the Association for 1983-84, has been a member of the M.I.T. faculty since before completing his doctorate in mechanical engineering in 1957. His early research and teaching were in computer-aided design, but since the mid-1960s Professor Mann has focussed on applications of engineering for rehabilitation of the blind and amputees—a field in which

E. Bizzi

he has been widely honored.

To complete Professor Mann's term as vice-president of the Association, to which he was elected just a year ago, the Selection Committee has extended through 1984 the term of **Richard A. Jacobs,** '56, a principal in A. T. Kearney, Inc., Chicago.

Bizzi to Head Whitaker College

After leading the Whitaker College of Health Sciences, Technology and Management through its formative years and into a permanent home in the Whitaker Building, Dr. Irving M. London has resigned as its director.

He'll be succeeded on July 1 by Dr. Emilio Bizzi, Eugene McDermott Professor in the Brain Sciences and Human Behavior.

It's a major change in the management of M.I.T. activities in health science and biotechnology, for Dr. London has been a principal architect of these programs since he first came to the Institute in the early 1970s. Dr. London will continue to direct the Harvard-M.I.T. Division of Health Sciences and Technology.

Educated in Italy, Dr. Bizzi joined the M.I.T. Department of Psychology in 1969, and he has since gained the position of a leading research contributor to the neurosciences. His current research involves the role of the central nervous system in motor coordination—for example, the neural control of arm movement in humans and primates. Earlier research has been on sleep mechanisms, cortical control of eye movement, and coordination of eye and head movements—all of these leading to an influential unifying concept concerning the control of movement. Dr. Bizzi holds the W. Alden Spencer Award for "outstanding contributions to the understanding of motor control."

The M.I.T. Symphony Orchestra played at Carnegie Hall last spring. Said a review in The New York Times *by Edward Rothstein: "Conducted by David Epstein for more than 15 years, the group of musicians from the M.I.T. and Wellesley university communities are a refined and disciplined ensemble."*

The 95-piece orchestra played a program of 20th century music including Incidental Music for Shakespeare's The Merchant of Venice *by John Harbison, Professor of Music at M.I.T., and Piano Concerto, Opus 90 by Vincent Persichetti. The program also included Igor Stravinsky's* The Firebird *(Suite, 1919 version). (Photos: Owen Franken, '68)*

Professor Emeritus Harold "Doc" Edgerton, '27, is congratulated on his 80th birthday by Howard Johnson, former President of the Corporation, and many from the M.I.T. community. (Photo: Laurie Goldman from The Tech*)*

On Harold Edgerton's 80th Birthday "Strobe Alley" Is Official

The first sight as one emerged from the stairs into the crowded fourth floor of Building 10 was a huge cake sporting an extremely realistic one-foot-high model of an apple with a bullet speeding through it (an edible recollection of Dr. Edgerton's famous strobe photo). The occasion: an 80th birthday party for Professor Emeritus Harold "Doc" Edgerton, '27, last April 6. M.I.T. dedicated the west half of the corridor as the Harold E. Edgerton Strobe Alley. The hallway serves as a gallery for a collection of the famous stop-action photos by Professor Edgerton and his colleagues and of hardware and other memorabilia.

President Paul E. Gray, '54, spoke for everyone in recalling how Dr. Edgerton has touched the lives of thousands of students and professors at M.I.T. He described Doc Edgerton as a "beloved colleague and friend" who "ranks foremost" among those who have brought international fame to the Institute.

Around the newly unveiled plaque identifying the hall, crowds of well-wishers watched demonstrations of some strobe effects with water drops, were entertained by the Electrical Engineering Alley Cats (specially named for the occasion) and listened and participated in renditions of "You Are My Sunshine," "She'll be Comin' Round the Mountain," and "When the Saints Go Marching In" with Doc Edgerton singing and playing his guitar.

Wadleigh Leaves as Vice-President and Dean

Kenneth R. Wadleigh, '43, vice-president and dean of the Graduate School, leaves those posts on July 1; he'll return after a year's leave of absence to his faculty post as professor of mechanical engineering. Meanwhile, his administrative assignments as vice-president will be reassigned to other officers of the Institute, and Professor Frank E. Perkins, '55, associate provost, will also become dean of the Graduate School.

Dr. Wadleigh joined the faculty in mechanical engineering even before completing his Sc.D. in the department (1953). He served as dean of student affairs from 1961 to 1969—the years of student tension over the Vietnam War and the Draper Laboratory's military research—and then became vice-president. He is credited by President Paul E. Gray, '54, with "immeasurable" contributions to the what Dr. Wadleigh calls the "sixth school, the extracurricular programs and activities," including especially the residential program and facilities.

MacVicar to Carnegie

Margaret L. MacVicar, '65, associate professor of physical science who is known for her founding and advocacy of the Undergraduate Research Opportunities Program (UROP), will share her time starting on July 1 between M.I.T. and the Carnegie Institution of Washington, of which she has been named vice-president.

Dr. MacVicar, who also holds the Cecil and Ida Green Professorship in Education at the Institute, will work with the president of the Carnegie Institution on research and education policy, personnel and financial matters, and the setting of research directions. The job, she says, was irresistible, program and policy innovation in higher education being one of her major professional interests.

Dr. MacVicar will be on leave from M.I.T. part-time during her first six months of work with the Carnegie Institution; then she'll resume teaching and advising responsibilities at the Institute on a half-time basis while continuing to work on policy and financial administration in Washington.

President Paul E. Gray, '54, cited Dr. MacVicar's "sensitivity, effective leadership, and impressive administrative skills" in the development of UROP.

Learning Japan Firsthand

"People from M.I.T. spend a year at General Electric or Westinghouse. Why not spend a year at Hitachi or Mitsubishi?"

That's the way Professor Richard J. Samuels, Ph.D.'80, of the Department of Political Science explains the student exchange part of the M.I.T.-Japan Science and Technology Program, which will flower next year with the selection of eight M.I.T. students to work for the year in Japanese industrial firms, universities, and research centers.

"There is no technologically advanced foreign country less understood and more in need of understanding by America's technological leadership than Japan," says Professor Samuels. He hopes the students will return a year hence with the more sophisticated understanding of that country that he believes is essential for the U.S.—a small beginning on a major task.

The eight M.I.T. students who will go to Japan this summer: Steven Cohen, '84, who wants to study for the year at one of several Japanese universities in his field of electrical engineering; Patricia Cullen, a graduate student in materials science, will work on thin film devices in Hitachi's Central Laboratory; Ji Hoon Hong, '83, will take his new economics degree to the Research Institute of Telecommnications and Economics after commencement; Robert J. McGreevy, '83, has applied for graduate study in chemical engineering at Osaka and Tokyo Universities; Patricia A. Morros, a graduate student in materials science, has been invited to work in Japan's National Institute for Research in Inorganic Materials; Peter J. Poole, a graduate student in civil engineering, will study in the International Course at Kyota University; Helen Segal, a materials science graduate student, has a one-year appointment to work on superalloys and composites at Matsushita Electric Co.; and Tanya C. Sienko, '83, will begin graduate study in physics at the University of Tokyo.

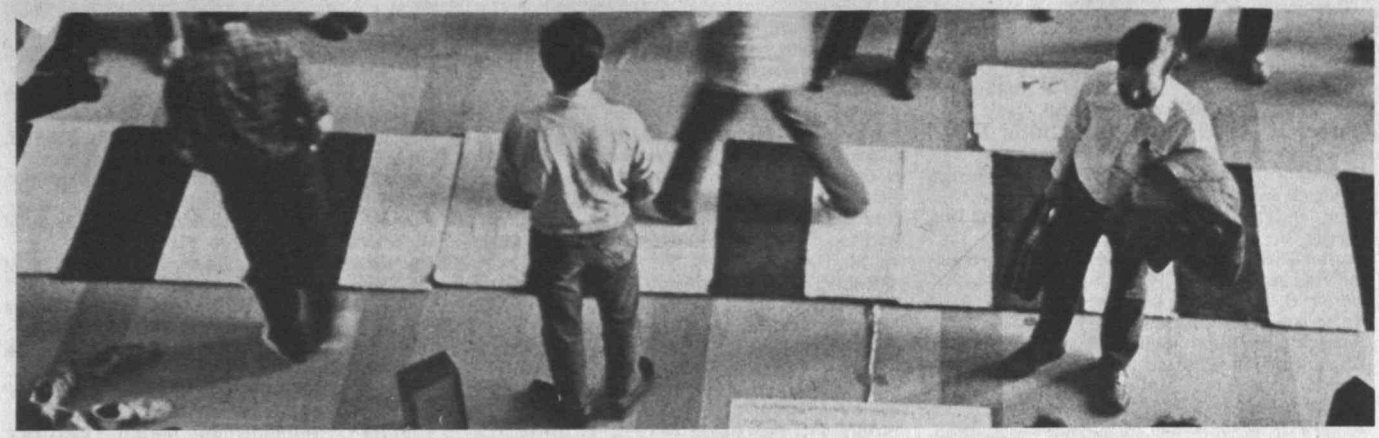
Crime Coming Down

Good news from James Olivieri, chief of the Campus Police: crime was significantly lower at M.I.T. in 1982 than in the previous year.

There was a decrease in all categories of crime, said Chief Olivieri in his annual report—bicycle theft down 57 percent, "crime against persons" down 20 percent, and motor vehicle thefts down 13 percent. Property losses due to theft dropped, too—Institute property losses were down 39 percent and campus residents' losses were down 52 percent.

Meanwhile, the Campus Patrol was busier than ever: for example, there were 2,556 calls for medical help in 1982, up 17 percent from 1981.

But even better reading for the community was *The Tech*'s tribute to Chief Olivieri and his force—"an outstanding model for police in any community, large or small," wrote the staff in an editorial on April 15. ". . . Chief Olivieri and his staff . . . have developed a caring, supportive, and—most important—friendly relationship with those they serve."



A Musical Sidewalk was installed in Lobby 7 last spring by members of Tau Beta Pi, the National Engineering Honor Society. It was played by delighted passersby for several hours. (Photo: Calvin Campbell)

Musical Sidewalk

What's black and white, fuzzy, and makes music when you step on it? It's the "musical sidewalk," a unique instrument which re-emerged in the Building 7 lobby this spring after a year's absence.

The sidewalk consists of tapeswitch mats (like those used for supermarket doors) covered by carpeting and arranged in the pattern of a piano keyboard. To play, one merely steps on a "key"—each is connected to a box with electronics in it to make the appropriate tone for each mat. From there, a normal hi-fi amplifier and speakers are used.

Built early last year by John Gonzalez, '82, and Neil Singer, '83, as a Tau Beta Pi (national honor society) pledge project, the sidewalk was installed several times around the Institute for testing and made its formal debut at the Cambridge River Festival last May. Now the "musical sidewalk" belongs to the M.I.T. chapter of Tau Beta Pi, which shows it off when time permits. "It's plenty of work to set up," according to John Gonzalez, now at Stanford, "You have to arrange all the mats, wire them to the electronics, and set up the amplifier and loudspeakers as well. Obviously, it's not something you leave up overnight, either."

But the crowds of curious onlookers and the people using their hands, heads, and tumbling bodies, as well as their feet, to play the keyboard, assure the sidewalk a bright future. Rumor has it that a local dance company is considering choreographing a piece to be performed on it, perhaps the first time that dancers have supplied accompaniment for their own performance.—*Peter Mui, '82*

J. M. Utterback

Utterback to Industrial Liaison

Professor James M. Utterback, Ph.D.'68, who has worked with the Center for Policy Alternatives in research on innovation and productivity for more than a decade, will become M.I.T.'s director of industrial liaison on July 1.

It's a big job—responsibility for the Institute's relations with scores of industrial firms in the U.S., Canada, Europe, and Japan that make unrestricted contributions to M.I.T. and share Institute activities in fields of common interest; and for stimulating faculty contacts with these and other industrial firms who can share technical and managerial interests with M.I.T.

Professor Utterback succeeds Professor James D. Bruce, Sc.D.'64, who leaves the Industrial Liaison Office after four years as director to become director of information systems.

Meeting the President

President Paul E. Gray, '54, says he has been visited by "everybody imaginable" during 18 months of "open office hours" last year and this. Mostly students, which is what he expected, but other people, too—secretaries, administrative and academic staff, librarians, research staff, even spouses of students and staff.

Among recent visitors:

☐ Eight members of the Association of Puerto Rican students came to tell the president about their group.

☐ Two students came in to ask Dr. Gray to dine with their living group.

☐ Two graduate students came in to talk about commencement—the format, the quality of the music, the sound system.

The door is open to everyone between 3:30 and 5:30 two days a month, announced in advance in *Tech Talk*, and 15-minute appointments can be made beginning that morning. Only twice has Dr. Gray had to refuse appointments—people involved in formal grievance proceedings with the Institute, whom he could not see without prejudicing the grievance proceedings.

In general, there are three categories of visitors, says Dr. Gray: those with a specific problem—a grade, a bill, or a question; those who want to express a point of view on a controversial subject; and those who just want to get to know the president better. All are welcome, says Dr. Gray. Indeed, he's delighted with the way this new tradition has brought him together with so many people he would otherwise have never met at all.

Deceased

Charles B. Cox, '03; March 15, 1983; 1200 Madison Ave., Wenatchee, Wash.
Kenneth F. Trimingham, '09; February 2, 1983; c/o Trimingham Brothers Ltd., PO Box 471, Hamilton, Bermuda.
Charles L. Bartlett, '11; March 9, 1983; 128 James River Dr., Newport News, Va.
Thomas S. Killion, '11; February 20, 1978; c/o Joseph H. Killion, 282 Edgehill Rd., Milton, Mass.
John H. Scoville, '11; December 22, 1982; 44 North Quaker Lane, West Hartford, Conn.
Kenneth B. Blake, '13; November 15, 1982; 7634-114th Pl. SE, Renton, Wash.
John F. Wostrel, '15; March 17, 1983; 28 Orchard Ave., Waban, Mass.
Louis Gerstle Mack, '16; February 14, 1983; 360 E. 55th St., New York, N.Y.
John M. Phillips, '16; September 16, 1982; 9612 Old Bonhomme Rd., Olivette, Mo.
Hyman B. Ullian, '16; April 5, 1983; 35 Dolphin Rd., Newton Center, Mass.
Chester K. Allen, '17; 1983; 13710 Grasmere Rd., Silver Spring, Md.
Howard L. Melvin, '17; February 3, 1983; 375 Rock Green Pl., Santa Rosa, Calif.
Thomas W. Ryan, '17; February 7, 1983; 114 N. Elizabeth, St. Louis, Mo.
Oscar W. Andersen, '18; December 13, 1982; 656 Hightree Rd., Santa Monica, Calif.
Robert T. Gidley, '18; January 7, 1982; 3100

Amherst St., Dallas, Tex.
Herbert J. Goldsmith, '18; June 17, 1982; 852 Timberhill Rd., Highland Park, Ill.
Edgar N. Goldstine, '18; January 5, 1983; 1880 Jackson St., Apt. 304, San Franciso, Calif.
George A. Sackett, '18; March 1983; Marian Manor, 33 Summer St., Taunton, Mass.
Charles F. Simpson, '18; 1978; c/o Raymond Savignal Assoc., PO Box 2282, Tampa, Fla.
Henry R. Whiton, '19; August 14, 1982; 7204 University Dr., Richmond, Va.
Robert N. Scott Baker, '20; May 1982; 305 Hamilton Rd., Wynnewood, Penn.
Harold G. Bower, '20; September 14, 1982; 8400 Vamo Rd., Apt. 811, Sarasota, Fla.
Albert Calvert, '21; January 3, 1983; 68 Clarke Circle, Needham, Mass.
Harry Cole, '21; January 30, 1981; 2707 Westgrove Ln., Houston, Tex.
Andrew D. MacLachlan, '21; February 2, 1983; PO Box 3, Hoosick, N.Y.
George P. Anderson, '22; February 1, 1983; 3091 Magnolia Dr., Hendersonville, N.C.
Harold R. Blomquist, '22; March 9, 1983; 3 Huckins Neck Rd., Centerville, Mass.
George F. Hamer, Jr., '22; February 19, 1983; PO Box 51, New Castle, N.H.
Walter R. Moore, Jr., '22; February 18, 1983; Middle Grove, Middle Grove, N.Y.
Warren D. Sherman, '22; July 24, 1982; PO Box 327, Farmington, Conn.
Frank C. Vogel, '22; February 5, 1983; 356 Abbott St., North Andover, Mass.
John V. Cook, '23; March 12, 1983; 760 E Bobier Dr., Apt. 220, Vista, Calif.
Harry J. Davis, '23; January 24, 1983; 36 Tremont St., Peabody, Mass.
Bertrand A. McKittrick, '23; March 26, 1983; 1180 South Ocean Bvld., Apt. 5D, Boca Raton, Fla.
Nathan C. Norcross, '23; November 15, 1981; 2 Jerome St., Volcano, Calif.
Elmer Hutchisson, '24; April 10, 1983; 501 Portola Rd., PO Box 8037, Menolo Park, Calif.
William L. Keplinger, '24; January 26, 1983; 167 E. Heritage Village, Southbury, Conn.
John T. McCoy, '24; December 22, 1982; 49 Canterbury Lane, Westfield, N.J.
Russell E. Robertson, '24; 1980; General Delivery, Eaton Center, N.H.
Clarke Williams, '24; March 15, 1983; 200 S. Country Rd., PO Box W, Bellport, N.Y.
Charles M. Boardman, '25; January 5, 1983; 110 Bevington Rd., Pittsburgh, Penn.
John A. Day, '25; December 3, 1982; Gilmore Pond Rd., Jaffrey, N.H.
George J. Gross, '25; January 12, 1983; 1415 Glendale Rd., Baltimore, Md.
Helen T. Jones, '25; November 26, 1982; 29 Broad St., Salem, Mass.
Fred C. Sommer, '25; March 11, 1983; 87 Bueno Vista Dr., Dobbs Ferry, N.Y.
Edmund P. Capone, '26; August 16, 1980; 2 Lake St., Sherborn, Mass.
Robert W. Dennis, '26; May 23, 1982; 70 Hill St., Milford, Conn.
Karl French, '26; February 7, 1983; 33141 Zellar St., Lake Elsinore, Calif.
William Sackville, '26; 1982; PO Box 364, Lake Worth, Fla.
Robert E. Whitford, '26; December 9, 1982; 4814 Rodney Rd., Richmond, Va.
James D. Flagg, '27; February 27, 1983; 301 W. Hills Rd., Knoxville, Tenn.
Eric G. Piper, '27; January 12, 1970; c/o Bird Machine Co., South Walpole, Mass.
Joseph Franklin McDermott, '28; March 11, 1983; Baywood Dr., PO Box 545, South Orleans, Mass.
Lincoln W. Fitts, '29; January 18, 1983; RFD 1, Peterborough, N.H.
Ralph E. Manchester, '29; December 10, 1982; 136 Turnpike St., Eastondale, Mass.
Devereaux Martin, '29; February 2, 1983; 10513 Haines Cyn, Tujunga, Calif.
Newell W. Mitchell, '29; October 26, 1982; 29 F Heritage Village, Southbury, Conn.
Theo A. Dourdeville, '30; September 1982; RFD 1, Jefferson, Mass.
Juel H. Lensch, '30; December 1982; 26 Muth Dr., Orinda, Calif.
Gerry E. Morse, '30; February 2, 1983; 2649 S. Wadsworth Blvd., Lakewood, Colo.
Worthen H. Taylor, '30; March 24, 1983; 46 Hanover St., Newburyport, Mass.
Richard D. Mason, '31; November 18, 1982; 6211 N. Calle Minera, Tucson, Ariz.
Frederick P. Fay, '32; October 23, 1982; 5616A Roxbury Terrace, Indianapolis, Ind.
Addison S. Hall, '32; February 22, 1983; 11 Downing St., Hingham, Mass.
Alfred W. Halper, '32; March 17, 1979; 5 Wiswall Rd., Newton Center, Mass.
Alfred G. Reidell, '32; March 5, 1983; PO Box V, Azusa, Calif.
Albert A. Stewart, '32; February 24, 1983; 223 Howland Rd., Westport, Mass.
William I. Stieglitz, '32; December 10, 1982; 9 Howard Dr., Huntington, N.Y.
Stephen J. Alling, '33; February 6, 1983; 7376 Kirkwood Lane, Cincinnati, Ohio.
John W. Powers, Jr., '33; December 9, 1979; 401 Yorkshire Dr., Birmingham, Ala.
William A. Soley, Jr., '33; 1982; 10 Post Office Sq., c/o Douglas Ley, Boston, Mass.
Glenn J. Baker, '34; August 15, 1980; 24140 Lupin Hill Rd., Calabasas, Calif.
Edward D. Rich, '34; March 9, 1983; 1363 Spinnaker Dr., Ventura, Calif.
Franklin C. Safford, '34; May 11, 1981; c/o Drever Co., Red Lion & Philmont, Huntingdon Valley, Penn.
John C. Turnbull, '34; May 4, 1982; 80 Peach Lane, Lancaster, Penn.
Thomas C. Donnahue, '35; March 18, 1983; 307 Yoakum Pkwy., Apt. 403, Alexandria, Va.
Donald A. Morrison, '35; February 24, 1983; 440 Pepperidge Tree Lane, Butler, N.J.
Isaac H. Munro, '35; July 5, 1982; 1777 SE 10th St., Fort Lauderdale, Fla.
Julian P. Perry, '35; January 10, 1983; PO Box 93, Holicong, Penn.
John A. Meeks, '36; July 16, 1981; c/o Dr. Laura Meeks Festa, 82 Ridgelake Dr., Columbia, S.C.
Lea H. Spring, '36; June 9, 1982; PO Box 415, Crookston, Minn.
John L. Everett, '37; March 20, 1983.
Alvin J. Garber, '37; February 10, 1982; 10409 Hutting Place, Silver Spring, Md.
Louis H. Laforge, Jr., '37; April 17, 1978; 1461 Ascension Dr., San Mateo, Calif.
Philip Short, '37; December 28, 1981; 35 Meadow View Rd., Milton, Mass.
Charles Barrett Campbell, '39; January 6, 1983; 1075 Lighthouse Ave., Apt. 217, Pacific Grove, Calif.
Joseph F. Coffey, '39; July 20, 1981; 701 S. Skinker Av., Apt. 905, St. Louis, Mo.
Robert J. Davidson, '39; December 31, 1982; 169 Key Palm Rd., Boca Raton, Fla.
Arnold Arch, '40; March 31, 1983; 4731 Bayard St., Pittsburgh, Penn.
Robert H. Levis, '40; September 25, 1982; PO Box 541, Alton, Ill.
Jane S. Rodman, '40; February 26, 1983; RT 1, PO Box 158, Millers, Md.
Arthur H. Ross, '40; December 13, 1982; 207 Hallmark House, Hershey, Penn.
James E. Gordon, '41; May 14, 1982; 70 Remsen St., Apt. 10A, Brooklyn, N.Y.
Arthur W. Keylor, '41; August 17, 1981; 33 Summit Ave., Bronxville, N.Y.
Raymond F. Koch, '41; November 3, 1982; 285 White Oak Ln., Winnetka, Ill.
Gilbert S. Graves III, '43; 1982; 516 E. Meade, Evansville, Ind.
Forrest S. Pearson, '43; June 17, 1981.
Bertram Paul Schmitt, '44; June 1982; 635 Roslyn Ave., Glenside, Penn.
Douglas B. Smith, '44; March 27, 1983; 7013 W. Greenvale Pkwy., Chevy Chase, Md.
Ralph D. King, '47; December 18, 1982; 8363 Riesling Way, San Jose, Calif.
Ernest P. Klipfel, '48; 1977; 156 Spring Grove Rd., Pittsburgh, Penn.
Richard W. Kilburn, '49; November 21, 1981; 101 Greenwood Rd., New Providence, N.J.
Robert J. Sullivan, '50; February 3, 1983; 49 Oldfield Rd., Sherborn, Mass.
Byron F. Burch, Jr., '51; October 28, 1982; 8333 E. Valley Vista Dr., Scottsdale, Ariz.
Gerald S. Rose, '51; January 1983; 5555 S. Everett, Chicago, Ill.
Vincent C. Gilbert, '53; February 14, 1983; 16800 Quarry Rd., Los Gatos, Calif.
Bennett Sack, '53; November 6, 1982; 2004 Murdstone Dr., Pittsburgh, Penn.
Richard L. Eaton, '54; January 9, 1983; 11 Lincoln St., Exeter, N.H.
Charles E. Leonard, '54; March 1, 1981; 14 Elsom Parkway, Burlington, Vt.
Miguel Colina Marie, '59; August 31, 1982; One Mason St., Brookline, Mass.
Richard S. Daleas, '62; February 3, 1983; 3 Beacon Hill Dr., West Hartford, Conn.
Rudolf K. Schmid, '65; March 12, 1983; Bundtacherstrasse 14, 8127 Forch, Switzerland.
James C. Murray, '68; March 1983.

Ralph A. Fletcher, 1895-1983

Ralph A. Fletcher, '16, chairman of the board of the H. E. Fletcher Co. of Westford, Mass., died on February 11 in his Goffstown, N.H., home; he was 87.

Mr. Fletcher was active in alumni affairs for many years, and he had been president of his class since 1952. He had also made important contributions to quarrying and finishing stone, the business of the family company operating a quarry and mill in Westford, Mass.

Lawrence J. Heidt, 1904-1983

Lawrence J. Heidt, associate professor of physical chemistry, emeritus, died on April 4 in the New England Rehabilitation Hospital, Woburn, Mass., following a long illness. He was 78.

Professor Heidt joined the M.I.T. faculty in 1935, and he remained at the Institute until his retirement in 1969, teaching courses in general and physical chemistry. His undergraduate and graduate degrees in physical chemistry were from the University of Wisconsin, and he did postgraduate research at Harvard for five years before coming to M.I.T. Professor Heidt held patents on a sterile sugar solution used in intravenous therapy and on procedures used in the insulation of power cable.

Leighton B. Smith, 1897-1983

Leighton B. Smith, '19, who taught chemistry at M.I.T. from the time of his graduation until 1935, died in Beverly (Mass.) Hospital on April 15 after a brief illness; he was 86.

Dr. Smith earned three degrees in chemistry from M.I.T. At the time of his retirement in 1961, Dr. Smith was professor and chairman of the Chemistry Department at Tufts University. Earlier he had worked at Lever Brothers in chemistry research for 17 years, including two years as manager of the firm's basic research activities.

Classes

10

Walter M. Saunders, Jr., '22, sends word of the death of **Fred R. Lufkin**, secretary for the Class of 1910, on April 6 at his home in Portland, Me. After he graduated from M.I.T., Mr. Lufkin was employed as an electrical engineer in various fields and with railroad equipment. He later returned to Portland where he was associated with Portland Tank and Copper Co. for six years. He was an active member of several charitable societies. His wife, Mabel, died in 1954, and he is survived by a nephew and three nieces.

Mr. Saunders writes, "He was a regular member of the M.I.T. Club of Portland and attended most of its dinner meetings. For several years, he visited (at least once a week) professor **John Babcock** at the nursing home where Mr. Babcock lived, and before that I understand they went many places together. He was very well liked, and up to the end apparently in excellent health".—*Ed.*

13

By the time you read this, Alumni Day will have come and gone. We wish we could have attended, but it was not possible.

Kenneth B. Blake's wife, Hazel, writes that Ken died on November 15, 1982. She says, "His going was without warning or suffering. He lay down for a nap and didn't wake up. 'His body just wore out,' said his doctor. Surviving him besides his wife are a half-brother, Walter Blake, '27; a son, also Walter Blake, '59, who works for Boeing; a daughter, Anne Marder, her husband, Ira, and their two young sons. We celebrated our 53rd wedding anniversary on September 15."

We have also been notified through the Alumni Office of the death of **Charles Albert Smith** on October 25, 1982 at the age of 94. A native of Boston, he was graduated from Bowdoin College in Maine with the class of 1910 and from M.I.T. in 1913. He was active in the M.I.T. Alumni Association. Before his retirement, he was with Barnett, Hopen, and Smith of Pasadena, Calif., often contracting engineering projects for various southern California cities. He also was city engineer of San Marino and Gardena for many years. He is survived by his wife of 65 years, Rose G.; two sons, David F. of Corona and Donald R. of Arcadia; five grandchildren and ten great grandchildren.

I'm waiting to have my vegetable garden rototilled and am anxious to start planting. Hope this growing season will be better than last year.—**Rosalind R. Capen**, Assistant Secretary and Treasurer, 7 Brackett Point Rd., Biddeford, ME 04005

14

Evelyn Blackhall, **Earle Mitchell**'s daughter, writes, "I am also secretary for my class at Skidmore College and know *exactly* the problems you have trying to get news for your column. Therefore, I am making my father sit down and dictate the following to you. Good luck with the rest of the gang! . . . 'I am in my 25th year of retirement after working for 40 years for Phelps Dodge, most of the time in the manufacture of wire and cable products. Since then I have been living in Ft. Lauderdale. My wife died several years ago and I have been leading a bachelor's life since then with visits from my three daughters and my stepdaughter who keep me on the straight and narrow. My chief exercise is walking my dog several times a day and my chief reward is having a couple of drinks. I have maintained my agility by avoiding all the wealthy widows who are after me.' "

Would that other classmates had daughters like Earle's!—**Charles H. Chatfield**, Secretary, 177 Steele Rd., West Hartford, CT 06119

15

Trust every '15er is having a fine summer, and having fun! It is absolutely amazing how I receive mail from classmates, and for these notes have had letters from **Otto Hilbert**, advising it is nice to have 1915 news in the *Review*, and wishing me a speedy hip recovery. Otto is well, but has to take it easy; however, he reports that he is still very extensively working on the Corning Glass history, which keeps him in touch with old friends who help him in the recollection of the early Corning Glass history, data, and facts . . . **Bob Welles**, way out in Ashland, Ore., who has always been another faithful one to keep in touch, wishes me a speedy recovery and extends his best regards to the gang. He's feeling good and enjoying the class notes, as well as his every day life. Bob has always had a California address, so I am going to find out about this Ashland, Ore. residence. Hard to keep up with you fellas!

George Easter writes a fine letter and informs me he is also happy to see class notes. He reported that it was the first winter in a long time that he's stayed in Buffalo for the season. Never before, he says, have we had a winter like this in western New York—hardly any snow, mild, and sunshine, and actually by far better than what the folks in Florida experienced this past winter. He has a very interesting family—three sons and a daughter, eight grandchildren and five great grandchildren—scattered all over the country. Two of his grandsons are lawyers.

George flew out to St. Louis to his grandson's wedding, and during the recent summers he has traveled to Scandinavia, including Iceland, Vancouver, Hawaii, San Francisco, New Zealand, Australia, Fiji and Tahiti, Nova Scotia, and Quebec. He will be 90 in June, as most of the classmates are now about that age! He still lives in his fine home (I have been there, as he only lives about 25 miles from my apartment in Lockport), drives his 1980 Buick, and really enjoys life.

Our good old faithful **Waldo E. Pike** passed away on February 16, 1983, and will be greatly missed. When I attended the 60th Reunion, **Azel Mack** and I drove Wally and his daughter, Marion, home, at 86 Irving St., Cambridge, because Wally had a flat tire. I shall always remember that wonderful 60th Reunion! Wally was a retired consulting engineer, a founding partner of Cleverdon, Verney, and Pike Consulting Engineers of Boston, and leaves a son, Waldo F., Jr. of Bridgewater; three daughters, Marion Pike of Cambridge, Edith Wall of Lexington and Cythia James of Troy, Mich.; and eight grandchildren.

This article is being written before Alumni Day, so will look forward to any news regarding the annual get-together, as I am hoping some classmates will be able to represent the Class Supreme! I cannot close until I again say how much I appreciate hearing from all of you, or each of you, and the news continues to be passed along in the *Review*. PLEASE KEEP IT UP!—**Joyce E. Brado**, ("Your old classmate - now fully recovered from the broken hip!") 491 Davison Rd., Apt. 9, Lockport, NY 14094

16

We acknowledge with gratitude the inspiration which continues to flow from '16ers. At the time of the loss of our beloved president **Ralph Fletcher**, we were picked up by the enthusiasm in letters and/or calls from **Dan Comiskey, Charlie Reed,** and **Paul Duff** urging us to get the planning underway for our annual class get-together. Annually in June, since 1951 we have had our three-day reunions. Last year we limited our reunion to a luncheon and by the time this column appears in print, we will have shared another reunion, our 67th. Thanks for the push. It exemplifies that class spirit which Ralph demonstrated and nurtured in us during his 31 years as our president.

We lost another good friend and classmate in **Hy Ullian** who died on April 5. His wife, Freida, passed away less than six months earlier. They had attended every class reunion and other of our functions for over 30 years. Beautiful people. . . . In recent years, we almost had the pleasure of seeing Dr. **Val Ellicott** at our reunions. Several times he was on the verge of attending and had even made reservations. His death on February 10 deprived us of this pleasure. . . . We received word that **Andrew C. Witherspoon** died in May 1982. May Hy, Val, and Andy rest in peace.

Hy Ullian, 87, president of Survey Service, served as a Navy ensign during World War I and after the war was a co-founder of the National Survey Service with offices in several Midwestern cities. He returned to Boston in 1932 and founded the New England Survey Service, of which he was president until his death. The firm handled several public works projects, including the Massachusetts Turnpike Extension, the Mystic River Bridge, Callahan Tunnel, and the Southeast Expressway. . . . V. L. Ellicott, physician, was 89. He received his medical degree from Johns Hopkins University in 1920 and a doctorate of public health from Hopkins the following year. He served in the New York state and Baltimore city health departments

in the 1920s. In 1932, he was selected as the public health officer of Montgomery county, a position he held for 22 years. He developed a well-rounded unit of health services which were known for their good relationships with voluntary groups and practicing physicians. In 1952, Dr. Ellicott traveled to Denmark and England on a World Health Organization fellowship to study services for the aged and the chronically ill. Two years later he was named chief of the Maryland State Health Department's Bureau of Medical Services and Hospitals. During his nine-year tenure, Dr. Ellicott was influential in changing the policy of Maryland's chronic disease hospitals from custodial care to one of rehabilitation. He retired in 1963.

Keep eating, drinking, walking, breathing, everything in moderation—and yes, of course, keep writing.—**Bob O'Brien**, Acting Secretary, H. E. Fletcher Co., Groton Rd., West Chelmsford, MA 01863

17

Joel W. Campbell died in his home in Fort Collins, Colo., on January 2, 1983. His son-in-law reports, "Mr. Campbell has a long and distinguished career with Bemis Bros. Bag Co. and served as an officer of one of Bemis's companies, Angus Jute Mill, for many years in India before returning to this country. He remained active in his civic and family affairs until a short time before this death." . . . **Chester K. Allen** of Washington, D.C., was reported on February 14 to have died "recently."

Leon Keach, a retired architect in the Boston area, writes, "Although my 89-year-old memory needs a frequent honing and the long walks have shrunken to strolls, with every park bench an invitation to sit and have a pipeful, the fact that my digestion is still uncomplaining can only be a compliment to my wife Gertrude, after 54 years of her good cooking."—**Walter J. Beadle**, Secretary, Kendal at Longwood, Box 217, Kennett Square, PA 19348

18

A most welcome letter comes from Biscuit (Mrs. **Samuel) Chamberlain**: "You and Selma and many of the classmates will be interested to know that I have finished the book about Sam's production as an etcher and that it will be published by the Boston Public Library sometime this summer. The printer has not yet given us a definite date. My co-author Jane Kingsland, and I are awaiting the solution of the usual last minute hang-ups in printing, binding, indexing, and other mechanical problems that always arise in the world of publishing. The book will be called *The Prints of Samuel Chamberlain, N.A.* and will be a true catalogue raisonnee, including all that can be known about Sam's work in drypoint, etching, and lithography." Biscuit also notes there will be about 300 beautifully reproduced illustrations.

Faithful **Just Abrams** writes: "I'll withhold my words of pains and woes for a better time. I've been a victim of arrhythmic heart disease, where one feels as though his heart is going to leap from his chest—not fatal—just wish me well at age 89."

Your secretary had occasion to visit the Compton Gallery adjacent to the M.I.T. Alumni Association office. Most recently I have been impressed by the showing of geometric sculptures designed by Morton C. Bradley, Jr., assisted by Arthur Pope and Louis Rosenblum, '42. These are geometric forms in thick paper, aluminum ground stock, brass wire, stainless steel, wood, and metal tubing. These are painted in varying colors which blend faultlessly. Some of these sculptures have been moved to the M.I.T. Historical Museum. I recommend your visiting them when you can.

It is with sadness that I report the passing of **George Sackett**. He and I worked on our thesis in our senior year together. He was a most modest and kind person with a most pleasant personality. I will chronicle his professional career in the next issue. . . . I also record the death of **Samuel P. Crotwell**, Jr. on December 3, 1982, and **Herbert J. Goldsmith** on June 17, 1982.—**Max Seltzer**, Secretary, 1443 Beacon St., Brookline, MA 02146; **Leonard Levine**, Assistant Secretary, 519 Washington St., Brookline, MA 02146

19

While in Florida at Delray Beach, our class President **Don Way** and his wife Barbara contacted Frances Smoley. "Twink," as she is lovingly called, is the widow of **Gene Smoley** who for so long was secretary of our class and kept you all posted on news from other '19ers. Of Mrs. Smoley's interest in our class I only need to quote as follows from Don's letter just received, "She was sorry to learn of the passing of several of our classmates about which I told her, particularly **Ev Doten** and expressed great interest in your plans for 1919's 65th Reunion. I told her we would keep her posted."

Mentioning again Ev Doten and thinking Charles W. Doten '34 might be related, we wrote him and he kindly answered that there was no relationship and he could not help us. If any reader has information please pass it on to me.

When you read this column you will be aware that our class is preparing for its 65th Reunion in June 1984. **George Michelson** is attending a joint meeting on April 12, 1983, at the Institute where all leaders of the 1984 reunions will be present. You will be hearing from your reunion committee in the year ahead. George himself reports: "I have been well and keeping as busy as I wish and following the careers of my ten grandchildren."

We are informed of the death of Mr. **Sarkis M. Madancy** on July 30, 1972. We have no further particulars and regret having to report it to you at this late date.

We talked by telephone with **Royden Burbank** who as you know is our class co-agent with **Dean Webster**. Royden is in good health and learning the ropes of his new assignment. He hopes that the recent upturning in the stock market will have a good action on class gifts. Incidentally, he went to school in Somerville, Mass. with Ev Doten who convinced him to go to M.I.T.

When more class notes come to light I will pass them on to you. Meantime, have a good summer and get in shape to attend our 65th.—**W.O. Langille**, Secretary, Box 144, Gladstone, NJ 07934

20

We hope to report in the next issue a goodly number of classmates and wives who attended the May meeting of the Cardinal and Gray Society. By the same token we (at this writing) look forward to an equally good turnout of classmates at the June Technology Day. Let us piously hope that these predictions come true, for, we have not a scintilla of news from the class—no changes of address, no nothing. Our purpose with these few words is simply to let you know that your secretary is still in the running and hoping for a word from you about your doings, activities, etc. At any rate, have a good summer, relax and enjoy. Class of 1920 and its members constitute a grand old class.—**Harold Bugbee**, Secretary, 21 Everell Rd., Winchester, MA 01890

21

A phone call from class president **Carole Clarke** on March 20, reported on the successful mini-reunion held in Florida on March 12-13. Those attending were Maxine and **Cac Clarke**, Graciela and **Helier Rodriguez**, Margaret and **Bill Sherry**, and Helen and **Miles Zoller**. **Irving Jacobson** had hoped to attend with his wife Ruth but didn't make it. They had two luncheons together and Cac said the new Disney Epcot Center was wonderful but really required a lot more time to do it justice. Helier was host for the mini-reunion get-together. Cac also reported hearing from class agent **Ed Farrand** who said he was enjoying life in spite of his poor eyesight. The Clarkes are planning to go to Cambridge for Technology Day and are hoping for another mini-reunion there. At the Florida meeting, 1921 was the oldest class attending and also had more alumni there than any other class.

A change of address came in from **Glenn H. Easton**. He has moved from Satellite Beach, Fla., to Virginia Hall, Apt. 302, 690 Osceola Ave., Winter Park, FL 32789.

Betty and **Sumner Hayward** accompanied by their daughter and granddaughter took a trip to Cape Cod the first week of April. We walked around the National Seashore, had a picnic lunch on the beach at Race Point, Provincetown, and generally relaxed and enjoyed it. One noon **Whitney Wetherell** had lunch with us at the Old Yarmouth Inn, and we were saddened to learn that Whit's wife Hazel had died mid-January after a long bout with cancer. Both of the Wetherells attended our 60th Reunion.

A good letter from **John Sherman** of Waltham, Mass., enclosed a book review for a book entitled *A Documentary of Prince Hall and Other Fraternal Orders*. Jack reports that he did the principal part of the research for the book and that the book would be of particular interest to Masons. He is still historian at the Masonic Temple in Boston where he goes to work every day. Copies of the book are available by writing Jack. He also tells me he lost his dear wife Rosabel last year after a prolonged illness. Our sympathy goes out to him.

There are two deaths to report this month: **Albert Calvert** of Needham, Mass., on January 3, 1983, and **Andrew MacLachlan** of Hoosick, N.Y., on February 2, 1983. Calvert retired as vice-president of New England Electric after 30 years of service. He served in the army in World War I. MacLachlan worked for B.F. Goodrich, held 13 patents, and designed the cable for the Golden Gate Bridge in San Francisco. He was a former chairman of the town of Hoosick planning board.

The Haywards didn't get to Florida this past winter as planned because of the death of their son from a heart attack in early January. Your secretary has been busy settling the estate, and so we missed visiting with our good friends the **Josh Crosbys** and the **Herb Kaufmanns** in Sarasota. We had hoped to have another mini-reunion with these classmates and **Helier Rodrigues** and **Dick Spitz** while we were in Sarasota. However, the weather in New Jersey was good so I hiked with friends almost every week. From what I heard, the weather in Florida was "rain, rain, rain."—**Sumner Hayward**, Secretary, 224 Richards Rd., Ridgewood, NJ 07450; **Josiah D. Crosby**, Assistant Secretary, 3310 Sheffield Circle, Sarasota, FL 33579; **Samuel E. Lunden**, Assistant Secretary, 1149 S. Broadway, Suite B-800, Los Angeles, CA 90015

22

A scarcity of news this issue. As I am writing in early April with the temperature below freezing now and then, perhaps hibernation is still in effect. In June just passed, **Martha Eiseman Munzer** read a paper at the national convention of the Society of Women Engineers in Seattle entitled "Are Engineers Ecological Literates?" To date, I haven't heard the answer. Martha keeps herself in training for her active writing life by swimming and sunning (when the sun's available) in Ft. Lauderdale.

Carlys and **Frank Kurtz** and **Frank Rickers** were in attendance at the Florida Fiesta in March. A further note from Frank K. explains that the reason **James F. (Jimmy) MacIntyre**, whose death was reported in the April *Review*, did not appear in the 1923 *Technique* was because he dropped out at the end of his sophomore year.

For those who remember **Freddie Blackall** who was killed in a private plane crash in Quebec in

1963, the following might be of interest. Freddie was Frederick Steele Blackall, Jr. His son was F.S.B. III, his grandson F.S.B. IV and now, arriving on March 6, 1983, we have his great grandson F.S.B. V. Five generations by the same name must be a first for our class. F.S.B. IV, Lafayette, '73, and M.I.T. '75 (M.S.), is currently director of manufacturing at Taft Pierce Company in Rhode Island of which Freddie in his time was president.

A letter by **Bill Elmer** recently published in the *Manchester* (NH) *Union Leader* raised the point about the improper linking of Lester Thurow's economic ideas with M.I.T.

Quoting from Bill's letter: "Some college professors seem to love to spout their own personal theories on TV, radio, and in the newspapers. When this happens they are quoted as being connected with this or that college or university. In this way many crackpot and zany ideas get linked with prestigious halls of learning to the detriment of our society."

Recent deaths: **Frank C. Vogel**, 83, died February 5, 1983, at his home in North Andover, Mass. He had a varied career working for the *Chicago Tribune*, Boston Woven Hose and Rubber Co., The First National Bank of Boston, Coopers, and Lybrand and the Internal Revenue Service. He was an active Mason and a World War I veteran. He is survived by his widow, a son, two daughters, a sister and nine grandchildren. . . . **Waller V. Morgan** died November 15, 1982, at age 85 in Pompano Beach, Fla. He is survived by a daughter, Mrs. A. Nelson of Charlotte, N.C. He was in Course V. The 1967 *Register* shows that he had retired prior to that date. I have no knowledge of his earlier career. . . . **George E. Taylor**, Course X, from Denver, Colo., died in February 1982 in San Diego, Calif., where he was living in retirement. He is survived by his widow. I have no knowledge of his lifetime work. Our condolences to the families of the above deceased.—**Yardley Chittick**, Secretary, Box 390, Ossipee, NH 03864

23

At this writing 83 persons are hoping or planning to come to our 60th Reunion, of which 46 are class members and the remainder are wives, widows, or guests. An account of the reunion will not appear in the notes until the October issue of the *Review* owing to the long lead time required for copy. We were at the Lighthouse Inn for our 55th Reunion, not the 50th, as was stated in the April notes.

Joel Lund writes that he probably will be unable to attend the reunion owing to illness. He speaks very happily of life in Charleston in an apartment overlooking Battery Park, the harbor, and Fort Sumter. . . . Mary and **Royal Sterling** leave July 27 from Vancouver, B.C., on the *Island Princess* to Alaska and hope that any classmates who may be aboard will step forward to be recognized. . . . **John Cook** died March 12, 1983, in Phoenix, his home, reported by a telephone call from his son. John graduated with our class in mechanical engineering. He was a native of Kentucky and attended the Georgia School of Technology before coming to the Institute. We have no information about his subsequent career.

Harry Davis died January 24, 1983, in Peabody, Mass., where he had lived for 45 years. He studied chemical engineering at the Institute, then was with the Bay State Chemical Co. of Peabody, and later became owner of the Paragon Color and Chemical Co. of Lynn, Mass., until 1974. He was a member of the Congregation Anshe Sfard and of the Brotherhood Temple Ner Tamid both of Peabody, and of B'nai B'rith.—**Richard H. Frazier**, Secretary/Treasurer, 7 Summit Ave., Winchester, MA 01890

24

As your scribe writes these notes, during a beautiful spring day (50 degrees Farenheit), he finds it difficult to project to a sweltering afternoon in July, while you relax in the shade, sipping a cooling Northern Special. Fortunately, there are no deaths to report, but things are moving for our 60th, only 11 months away.

We tried to interest **Phil Bates** in assembling an entertainment program, but in his methodical manner, he decided that California was too far away to really analyze our problems and possibilities. Rather timely, **Don Moore**, our 60th chairman, just attended a meeting for reunion class representatives, called by Joe Martori, to discuss their problems and solutions. Don came away with some pregnant answers. These will be hashed over at a luncheon, hosted by **Phil Blanchard** on April 19 at the Publick House, Sturbridge, Mass. Phil has just returned from several months in Florida, which were anything but healthy this year.

Don Moore sported the lone sombrero of 1924 at the March Mexico Fiesta. He inspected the ruins of the Aztec Temple, Oaxaca and Monte Alban supported on the distaff side by Luisa, widow of **Nish Carnish**.

At the luncheon on March 22, the class KGB cell—**Don Moore, Don Fife, Herb Stewart** and **Russ Ambach**—bantered problems of our 60th and estimated attendance of classmates. The results followed the current stock market antics with a low of 60 and a high of 100.—Co-secretaries: **Russ W. Ambach**, 216 St. Paul St., Brookline, MA 02146; **Herbert R. Stewart**, 8 Pilgrim Rd., Waban, MA 02161

25

Don Taber writes from Boca Raton, Fla., to provide the good news that on March 19, 1983, he was married to Wilmina B. Ehrenberg of Boca Raton and Holyoke, Mass. The wedding took place at the Christ Congregational Church in Princeton, N.J. The couple have been friends for 15 years. . . . **Willard (Bill) Asbury** announces his remarriage. His new wife is the widow of P.K. Frolich, '24. The couple's new address is: 1160 Wychwood Rd., Westfield, NJ 07090. . . . **Henry Sachs** sends greetings from New York and reports all is well with his family. He tells of his travels: "Escaped the winter weather by flying via San Francisco to Hong Kong where Bee and I boarded the *Royal Viking Star* for a three-weeks part of the world tour, stopping off at Thailand, Singapore, Penang, Colombo to Durban, South Africa from which we flew via London back to New York. Smooth seas at all times." Henry reminds us that he with Basil Zavoico, '24, started the M.I.T. Outing Club a year after he and **Ed Piepho** got a Speakers Club underway. Henry keeps in touch with Ed who now lives in Clearwater, Fla. Those of you who were members of the M.I.T. chapter of the Army Ordnance Association will remember that Henry was president in his senior year. He has remained a member of it and its successor the American Preparedness Association, being a director of the New York chapter. About a year ago he received their silver medal. To keep young Henry continues his insurance brokerage and is active with a number of charitable and city and country clubs.

A card from **Franklin Fricker** tells of a little mini-reunion on March 7 held at the Keywadin Club in Naples, Fla., and hosted by Elinor and **Sam Spiker**. Others present were Eleanor and **Fred Greer**, Jean and **Sonny Sonnekalb**, and Al French, '26. . . . **Calvin Campbell** was prompted to write **Franklin Fricker** having noted in recent class notes that Franklin attended a meeting with the Detroit Ethyls. With his letter Calvin included a copy of a talk he had given in 1980. It was entitled "Bring Back Ethyl." He has provided me with a summary of this talk which was included in the class notes of February 1980.

Roger Ward writes from Merritt Island, Fla., and his message should reach you in his own words. "A funny thing happened to me on the way to a ripe old age. In 1978 I sensed I wasn't batting 1,000 and for the first time in my life entered a hospital for a checkup. After five days they told me I was disgustingly healthy. Next week my knees folded while mowing my lawn. For two years I bounced around like a pinball between hotshot specialists, clinics, and hospitals. Finally they found that a wayward artery had wrapped itself around my spinal cord and was choking it. The neuromicrosurgeon told me if I did nothing in six months I would be a Brussels sprout and that I had a 50 percent chance of surviving an operation which wouldn't cure me but might help maintain a status quo. Well I'm still alive with complications including constant pain from the naval down on which doses of terminal cancer morphine have no effect. So I'm trying to enjoy my misery and my power plant shows every intention of indefinitely shuttling me between my wheel chair and bed with occasional outside help. I still live alone in the shadow of the Space Center." Roger asks that this message not be read as one of doom or gloom. For 74 years he led a wonderful life.

Ben Oxnard remembers my interest in philately and sent me first day issues of the Oglethorpe postcard. Ben notes that he unearthed a pin with "The Colonels" inscribed on it. As he remembers this was a group of reconstructed rebels from Georgia, Florida, etc.

It is with sorrow that we report the passing of **Charles M. Boardman** on January 5, 1983. Charlie spent most of his working life with the Duquesne Light Co. in Pittsburg where he resided at 110 Bevington Rd.—**F. Leroy (Doc) Foster**, Secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

26

Bill Jones has been in contact with **Dick Whiting**, who worked on a project with Roy Lamson, at M.I.T. Bill and Dick had both played in Roy's Harvard dance band. . . . **Jim Offutt** adds to our previous notes on **Jay Goldberg**'s death. He reminds us of his contributions to *Voodoo* and his co-authorship of the 1926 Tech Show. Those who knew him in Chemical Engineering Practice School fondly remember his wit and congeniality. Jim attended the Florida M.I.T. Fiesta in 1981 and saw **Elton Staples** who praised "the second time around" so strongly that Jim did the same in November after recovery from a triple bypass. . . . **Austin Kelly** tells us of the impending (April 14) 80th birthday of **Mark Greer** whose charming new wife, Mary, planned to surprise him with a small party for those living nearby in Florida.

Winslow Hartford, '30, passes on news of **Martin Grossman**'s marriage on November 27 to Laura Ann Trans of Charlotte, N.C. . . . While in Maui recently we talked to **Bill Forrester** who seems to enjoy a life filled with alternate days of golf and wave-watching on that most beautiful of islands. Since my wife became addicted to it I expect that we may have the opportunity to see Bill next winter. Bill mentioned that he thought the **A. E. Landaus** were staying at the Royal Hawaiian Hotel in Oahu where we missed them during our week there. Better luck next time. . . . Accompanying a gift to the Alumni Association was a brief note saying that **Sam Cole** suffered a broken hip from which he is convalescing. Best wishes for a rapid recovery, Sam! . . . A note from **Alden Peterson** says he is still working full time as director of economic development of the Marshal Area Authority.

A note from an Auburndale neighbor, **Edgar M. Holmes**, tells of his graduating from Harvard Medical in 1930 and practicing ear, nose, and throat and plastic surgery in Boston. Since 1976, he has been enjoying retirement. . . . A late notice advises of the death on September 13, 1982, of **Frank W. Gratz**, retired president of Trepel-Gratz Co., Inc., specialty manufacturers. He is survived by his widow at 15 Bishop Place, Larchmont, NY 10538. . . . Mrs. **Robert E. Whitford** writes of Bob's death on December 9, 1982, and mentions his pride at being an M.I.T. alumnus. . . . Another

notice advises of the death of Colonel **William Sackville** of Lake Worth, FL 33460. . . . **Karl French**'s widow, Lilium, married 59 years, writes of his death February 7 after a long illness. He is survived in addition by a son, daughter, nine grandchildren, and 17 great-grandchildren. Karl had a distinguished career in design, construction, research, and development in shipbuilding, including the structure of the *U.S.S. Missouri,* the heating and airconditionning of the revamped *Queen Mary* and numerous classes of U.S. naval vessels.—**William Meehan**, Secretary, 191 Dorset Rd., Waban, MA 02168

27

Your secretary has discovered a novel way to get a word from a classmate. After noting in the March issue that **Russ Westerhoff** had survived heavy doses of radiation treatments, he was subsequently referred to as "the late Westerhoff." Russ announces he is still going strong. His daughter was installed as pastor of the United Presbyterian Church in Little Falls, N.Y.

Larry Grew attended the luncheon meeting of M.I.T. Club of New Haven on April 6 with **George Darling**, professor emeritus at Yale. We would like to hear from George as a follow-up of our March notes.

Harold (Bud) Fisher underwent surgery and two weeks in the hospital and is now recovering well. . . . Another letter to **We-Tuh (Wally) Kwauk** in Honk Kong has been returned to **Bud Cole** marked "moved, address unknown." Bud recalls he was a healthy fellow and a captain of our boxing team. Now we can't find him. Bud adds that the west is beginning to dry out. Trees are leafing, flowers are blooming, goldfish are mating among the lillies. Spring!

Lucas E. Bannon died on March 29, 1983 in Beverly Hills, Fla. As the "irony of fate" would have it, just a few months ago we reported Luke's rejuvenation to practising architecture at 80. After his 30-year career and 22-year active retirement, Louise wrote that he died in his sleep after two weeks illness. He had three unfinished designs on his drawing boards. Luke was architect for municipal buildings and churches in Glen Rock, N.J., was borough architect for many years and served on the board of education. He was a member of American Institute of Architects, Royal Architects, Institute of Canada, the Architects League of New Jersey, and the National Council of Architects Registration Board. His final mass was held in St. Catherine's of Glen Rock, a church of his own design.

James D. Flagg died on Feburary 27, 1983, in Knoxville, Tenn. A civil engineer, in the early 1930s Jim went to the USSR and worked several years on the Dneiper Dam. After his return, he came to the Tennessee Valley Authority and spent the rest of his career on design and construction of TVA projects. He retired after 35 years service. He was a major in U.S. Marine Corps.

Lawrence B. Whit died on August 22, 1982, in Grand Rapids, Mich. He was a VI-A grad who digressed to other endeavors. In 1943 he organized the Rhode Island Public Expenditure Council. It was an organization composed of business, industry, and finance with the purpose of obtaining the greatest return for their tax dollars. Much progress was made under his direction at local, state and federal levels of government. In 1955 he had formed and was director of a similar council for the state of Connecticut. How fruitful his services could be now!

Richard Cutts, Jr., died on March 3, 1983, in Warwick, R.I. Dick will be remembered as editor for *VI-A News* and as senior business manager. He was dedicated to electrical engineering and the industry all his life. A touching note from his widow Esther: "After 42 years of good service to G. E. in many managerial capacities and 52 years of a happy marriage, Richard passed away. He had a five-year-long illness so I must rejoice that he has laid down his earthly weights for a better world. Thank you for doing this loving remembrance of a wonderful human being."

A further comment on the death of **Lester Woolfenden** reported in last month's issue came from his widow Ethel. She and Les met in 1915 in the fifth grade at school—a record 68-year-span relationship. A very significant paragraph in a resolution adopted by the board of directors of the Paducah Bank could well be remembered by many M.I.T. widows: "Whereas, at the close of life it is not really how much we have gotten, but how much we have given; not how much we have won but what we have done for people; how much we have served, not how many honors we have gathered. There have been few efforts to equal those of Lester B. Woolfenden, and we hereby reaffirm his countless contributions."—**Joseph C. Burley**, Secretary, 5 Hutchinson St., Milton, MA 02186; **Lawrence B. Grew**, Associate Secretary, 21 Yowago Ave., Branford, CT 06405; **Prentiss I. Cole**, Associate Secretary, 2150 Webster St., Palo Alto, CA 94301

28

When these notes reach you our 55th Reunion will be recent history. Yet, of necessity, we are writing these words two months prior to that event. Obviously it will be October before we can get a reunion report to you by this route. However, we can say that, as of this moment, everything looks good for a lively party with a projected attendance of about 150. Also, a good level of interest has been shown in the "Thoughts and Sentiments" project and we should have well over 100 contributed messages for inclusion in the book. Among those from afar were T&S notes from **Hugh B. Spalding** in Cheshire, England, **Jue T. Hu** in Shanghai, China and **Kashi Minocha** in Bhopal, India. Our many thanks to all those who participated.

Reunion correspondence tends to bring in a miscellany of news items—this is so now and we are glad to pass along those we have. Peggy and **George Mangurian** exchanged houses with another couple in California for three weeks last fall. Apparently it worked out very well. . . . Pam and **Rene Simard** spent two weeks last winter in Ocho Rios, Jamaica so as to escape at least some of the season's miseries back home in Canada. . . . **Nap LaCroix** finds winter conditions harder to bear as time goes on. Nap sees **Bill (W.T.) Hammond** on occasion and hopes that they can both be at the 55th. . . . Kay and **Ben Draper** are spending three weeks in April visiting with their daughter in Florida. Ben has been to nearly all past reunions but, regretfully, he and Kay are unable to be with us in June.

The honor of longest distance traveler will probably go to **Shikao Ikehara** who will be flying from Tokyo, Japan. His notes are short but enthusiastic. . . . **Hector Hagedorn** will be coming from Madrid, Spain, Helen and **Gabe Disario** from Caracas, Venezuela, Nella and **Leonardo Siller** from Col del Valle, Mexico, Miriam and **Clifford Terry** from Kailua, Hawaii, **Chuck Carter** from Pointe Claire, Quebec, Canada and **Rene Simard** from Ottowa, Canada. We had hoped to have **John Houpis** with us from Athens, Greece but problems at home will prevent him from coming.

With deep regret we must report the deaths of four classmates. **Thomas J. Murphy** (T. James Murphy) died September 18, 1982. Word of his death was received from wife Mildred. Murphy joined the Class in his sophomore year and graduated in Course VI, Electrical Engineering. He began his business life as an engineer for the Montana Power Company and then as an engineer for the State of Montana. Later he went into the livestock business (in Montana) and so continued with his own company for the rest of his productive life. . . . **Russell B. Wright** died October 14, 1982, in Deer Park, Cal. The information was very thoughtfully sent to us in a letter from his sister, Margaret. Russell was with us as a graduate student and earned his SM degree in Course VI, Electrical Engineering. . . . **Walter J. Nock** died March 3, 1983. We were informed of this in a letter from wife Lela. Walter graduated in Course III, Mining Engineering and this continued to be the field of his professional work. Upon graduation he went to work for the American Smelting and Refining Company where he progressed to vice-president and general manager of all Mexican operations. His entire business career was with the same company. The Nocks have a son, W. Ronald. . . . **Franklin McDermott** died unexpectedly March 11, 1983. Mac graduated in Course II, Mechanical Engineering and had several engineering positions before settling with Lever Brothers Company for his lifetime career in plant engineering management. Florence and I attended the memorial service for Mac in Orleans, Mass., and met with his lovely family. To the families of all these classmates we extend our heartfelt sympathy.—**Walter J. Smith**, Secretary, 37 Dix Street, Winchester, MA 01890

29

Joseph D. Murphy, FAIA, was awarded the first Gold Star Award of the St. Louis Chapter of the American Institute of Architects on March 2, 1983. He was selected for "his distinguished years of exemplary dedication to the St. Louis chapter, to his profession, and for his notable contributions to the architectural community in education and design." After graduating from M.I.T., Murphy studied at Fontainbleau and l'Ecole des Beaux Arts in France, receiving the Paris Prize in 1929. Following his extensive travel in Europe and work for several Kansas City architectural firms, he went to St. Louis in 1935 to teach design at Washington University, becoming dean of the school in 1949. He was awarded a fellowship in the American Institute of Architects in 1957, the sixth St. Louis architect to be so honored. His name is associated with numerous significant buildings in the St. Louis area including the municipal opera entrance shelter, Queeney Tower at the Barnes Hospital, the Olin Library at Washington University, St. Louis County Government Center, and many Catholic churches and schools.

Mirko Paneyko of Easton, Conn. sends greetings to all his friends and classmates. He is still active in his business of developing and manufacturing high fidelity audio equipment, manufactured by MP Audio Corp. of which he is the president. . . . Greetings and best wishes are sent to all '29ers from **John D. McCaskey** with a new address: Room 227, Keen Agers, 923 Powell, St. Louis, Mo. . . . **Arthur J. Bearse** of Charlotte Harbor, Fla., who never misses attending Technology Day with his friend **"Put" Cilley**, writes, "My son Peter opened an office for the practice of consulting economist in Princeton, N.J., in the fields of economic development, strategic planning, tax and fiscal problems, market analysis, etc. And, one of our daughters and her husband flew from Vienna to spend Christmas with us. This has been a wet winter here—we had over 12 inches of rain within the last two weeks. My health has improved quite a bit, and I am looking forward to seeing you at M.I.T. on Technology Day. Best wishes to all."

Charles B. Bacon of Middletown, Conn., writes, "I am still active in our mechanical contracting business and I go to work most everyday. Two of my sons, Bill and John, and a son-in-law are also in the business. They share the responsibility and carry most of the work load. I have no interest in retiring as long as I enjoy good health." The Bacons have six children and 13 grandchildren.

Florence, wife of **Ted Malmstrom** of Honolulu, Hawaii, sends a note: "Last May, we took a trip to visit our daughter Polly and her family. It was very difficult for Ted to travel such a distance and for me to cope with it. This might prove to be our last visit to the mainland. Ted's walking has deteriorated to a point that he uses a wheelchair for long walks. However, we still manage nicely and get around well with the help of our daughter, Jackie. The recent hurricane which devastated

certain areas here skipped our house. We wish that the Class of '29 would consider a trip here. We would love to see you. Best wishes to all of you."

Your secretary and his wife Helen, as in previous years, spent a delightful Easter with Marion and **Robert Pride** at their home at North Palm Beach, Fla. This has become a tradition between the two families, acting as host and hostess to each other on alternate years on Easter. This friendship between classmates spans over 55 years, beginning in high school days. After retirement, Bob and Marion moved to Florida some ten years ago, living in a comfortable two-bedroom condominium on a canal near Lake North. The Prides are planning to attend our 55th Reunion next year.

Barbara and **George Meyers** of Wyomissing, Pa., send greetings and best wishes to all their friends and classmates. George is continuing his management consulting business on a part-time basis. In addition, he took a year of temporary teaching at Penn State's Berks campus. He retired from teaching Sunday School and is applying his energies to the Episcopal Cursillo in which Barbara also participates. Barbara is also busy with Alter Guild, E.C.W., S.C.H.C. and Soroptomists. Their annual trip to New England to see friends of many years had a special event—their friends the Kingsleys' 50th wedding anniversary. They are looking forward to attending our 55th Reunion next year, which will also be Barbara's 50th at Radcliffe.

I received a telephone call from Ellie Horwitz Zeghera, a charter member of our recently organized widows program, informing me that Mary, wife of **Jerry Gardner** of Belmont, Mass., our general chairman of the 55th Reunion had passed away suddenly. A call to Jerry revealed that Mary had been in ill health in recent years, suffering from a chronic case of emphysema. She passed away in a coma after a severe attack. Jerry's address is 10 Radcliffe Rd., Belmont, MA 02178, for those who wish to express their sympathy to him. I regret to announce the death of the following members: **Deveraux Martin** of Tujungo, Calif., on February 2, 1983; **Sarto J. Nadeau** of Montreal, Canada, in July 1980; and **Franklin P. Nicholson** of Holmes Beach, Fla.—**Karnig S. Dinjian**, Secretary, P.O. Box 83, Arlington, MA 02174

30

It is gratifying to note that there are at least a few of our classmates who are still sufficiently active to win professional awards from time to time. This month there are two such "kudos" to be reported. Tom Harvey '28 was kind enough to send me a notice about **Frank Burley**'s receipt of the 1982 Community Service Award of the Indianapolis Scientific and Engineering Foundation. Like several of our other classmates, Frank has retired several times but refuses to stay retired. In 1968 he retired as manager of product engineering at Western Electric and thereafter joined the faculty of Purdue University's electrical engineering department. In 1973 he again retired, this time as dean of continuing education, but then continued teaching at the Indianapolis facility jointly sponsored by Purdue and Indiana Universities. The citation accompanying the award states in part that "Professor Burley through long hours including evenings and weekends has guided the lives and inspired students to accomplish their aims and goals. . . . His assistance to the needs of weaker students has motivated scores of them to return to the main stream academic world."

Sieg Linderoth was recently the recipient of the sixth annual Leonardo da Vinci award of the ASME for his work in designing high-pressure equipment. More particularly, last year at Duke University he designed a hyperbaric diving chamber that was used for a world's record simulated dive to a depth of 2,250 feet. The notice concerning Sieg's award was sent to me by another Duke faculty member, **Louise Hall**, who is now professor of architecture, emeritus and in retirement does volunteer work with the aging. Last year Louise went back to her 55th reunion at Wellesley, where she did her undergraduate work, and there met fellow architect and classmate **Margaret Surre Wilbur**. She and Margaret were pleased and rejuvenated by the fact that they were preceded in the academic procession by contingents from the Wellesley classes of 1922, 1917, 1912 and even "four sturdy little ladies of 1907." . . . Nina and **Wallace Hope** are living in Boone, Iowa, having moved there from Ramsey, N.J., when Wallace retired in order to be closer to their children and their seven grandchildren. Wallace is deacon, organist, and treasurer of the local Baptist Church. He also still does some consulting work for Gem Gravure Co. of W. Hanover, Mass.

As many of you know, although I use Southbury, Conn., as my year-round address for class notes purposes, Louise and I spend our winters in Green Valley, Ariz. In late March I made a brief trip east for a couple of meetings at the office and to attend a surprise 70th birthday party in Darien, Conn. for my brother Donald, '34, arranged by my son Bob (M.S., Sloan School, '73) and his wife Nina (formerly a lecturer on personnel management at Sloan). While at Bob's house I touched base with **Les Steffens** and **Dick Chindblom**, both of whom live in Darien. Les is an enthusiastic small boat sailor and has collected an array of trophies both at home and abroad for his sailing prowess. He is also an avid devotee of Allen Gottlieb's "Puzzle Corner" in the *Review*, ticket chairman of the local light opera company, and a United Way worker, as well as the owner of a large inquisitive dog. Dick Chindblom has promised to write me about his activities; hence I will defer comment about him until I receive his letter.

We have at hand notices concerning the deaths of three more of our classmates: **Gerry Morse, Sebastian Littauer** and **Ed Nolan**. All three died in February, the first two on February 2. Littauer received an undergraduate chemical engineering degree from Renssalaer in 1920, an A.M. in mathematics from Columbia in 1928, and an Sc.D. from M.I.T. in 1930 where he did his dissertation under Norbert Wiener. He had a long and distinguished career teaching mathematics at the U.S. Naval Academy, Newark College of Engineering, and from 1947 to 1969 at Columbia. He initiated the first course in operations research at Columbia in 1952. At the time of his death he was professor emeritus of operations research in Columbia's School of Engineering and Applied Science. . . . After M.I.T. **Gerry Morse** obtained a graduate degree from Harvard Business School and then went to work for Sylvania in Salem, Mass., and New York. In 1951 he moved to Honeywell in Minneapolis from which he retired in 1973 as vice-president in charge of employee relations. After his retirement he became president of the Council of Community Hospitals in Minneapolis until 1980, at which time he moved to Lakewood, Colo., where he lived at the time of his death. Gerry was exceptionally active in community affairs over a period of many years. According to my records, he worked with more than 20 civic and public service organizations in the fields of health, education, labor relations, management, and safety, in addition to his M.I.T. alumni activities. He is survived by a daughter Gillian and three brothers. . . . The news of **Ed Nolan**'s death came in the form of a clipping that Irene sent me. Ed worked for Merck and Co. in Rahway, N.J., for many years and lived in Mountainside, N.J. At the time of his retirement in 1970 he was plant manager and director of quality control. His memberships included the Union County chamber of commerce, the New Jersey Taxpayers Assoc. and the Canoe Brook Country Club. He was the director of the Junior Achievement program of Union County, a past president of the Rahway Kiwanis Club, and for a number of years president of the Mountainside board of education. After his retirement he and Irene spent quite a bit of time in Florida. Reunion regulars will recall that the Nolans attended quite a few reunions. In addition to Irene Ed is survived by two sons, two daughters, and seven grandchildren.—**Gordon K. Lister**, Secretary, 294-B Heritage Village, Southbury, CT 08648

31

Received a nice letter from **Bill Stellrecht**: "My second marriage, following the death of my first wife, has rewarded me with a happy life span of some ten years. Because she wished to see the world, we have undertaken many trips—Egypt, Greece, North Africa, Norway, Great Britain, and Italy, where we have a cottage near Riva on Lake Garda. A trip to the U.S.A. was a must for two reasons, because my wife has never been there and because I am dealing with an important infringement suit that has been pending for many years and is still proceeding before an appeal court. The hearing in Washington, which lasted ten days, was most interesting and elucidating as to U.S. court practice. All this shows that I am still active in the patent field as a free-lance Patenanwalt, but I have reduced my work to handling my old cases, which quite often last from five to ten years. Three younger partners, including my son-in-law, are in charge of the general routine work and handle all new cases in the fields of patents and trademarks.

"I do hope to visit the States once more in the next few years and meet a few of my old classmates. I would still like to see San Francisco, the Grand Canyon, Alaska, and Miami—and while there, to call on you. All of this really gives me something to look forward to." Many thanks, Bill. I hope your letter will encourage some others to write.

We have word of our members and wives who are going on our mini-reunion to Alaska in June. They are: Mr. and Mrs. **Richard C. Ashendon**, Mr. and Mrs. **C. Randolf Binner**, Mr. **Kenneth Bolles** and Ms. Ruth Campbell, Mr. and Mrs. **Eugene G. Branca**, Mr. and Mrs. **G. Howard Bryan**, Mr. and Mrs. **Joseph M. Buswell**, Ms. Minna Corbin, Ms. Edith Carpenter, Mr. and Mrs. **Kenneth Germeshausen**, Mr. and Mrs. **Arthur Newell**, Mr. and Mrs. **Enio Persion**, Mr. and Mrs. **Howard Richardson**, Mr. and Mrs. **Robert Sanders**, Mr. and Mrs. **Albert Sims**, Mr. and Mrs. **Elliot L. Whitaker**, Mr. and Mrs. **Allen P. Wilson**, and Mr. and Mrs. **Edwin S. Worden**. By the time you read this list, all of us will be back home. A report of the trip will follow in a later issue.

It is with regret that I report the death of our classmate, **John P. Tillinghast**. The last time I saw John was after his wife had died. He was walking along the beach at Longboat Key.—**Edwin S. Worden**, Secretary, P.O. Box 1241, Mount Dora, FL 32757; **Ben W. Steverman**, Assistant Secretary, 3 Pawtucket Rd., Plymouth, MA 02360; **John R. Swanton**, Assistant Secretary, 27 George St., Newton, MA 02158

32

The grim reaper is at work. It is my sad duty to bring you some obituaries. **Manly M. Windsor**, 81, died on December 7, 1982, at his home in Sheffield Lake, Ohio. He was a chemistry instructor at M.I.T. In 1945 he joined the McGean Chemical Co., where he worked until he retired in 1968 as director of research and development. He was very active in chemical and church organizations. He is survived by his wife of 54 years, Muriel, a son, a daughter, and grandchildren. . . . **Christian E. Grosser**, 73, died on January 17, 1983, at his home in Richmond, Va. He was active in research and development for many prestigious companies before becoming a private consultant in 1963. He had a large number of patents for mechanical devices and was the author of about 15 published articles. He is survived by his wife Dorothy and five sons and daughters. . . . **Albert A. Stewart** died on February 24, 1983. He was a retired professor of mechanical engineering at Southeastern Massachusetts University. He was active in many

organizations which included professional, church, art, and historical societies. He received a Ford Foundation grant in the fifties and was cited by M.I.T. president Howard Johnson for his outstanding work. His wife is his sole immediate survivor. . . . **Aldolph Warsher** writes that he has recently heard from the widow of **Joseph T. Cimorelli**. He died in June 1982 from a sudden heart attack. He had been retired from RCA for whom he had worked for many years.

In a lighter vein, **Francis T. Gowen** writes that the Gowens have "adopted" an Italian family. Last October they joined them in harvesting grapes in their vineyards and sampling their wines. From their base in Arezzo they made trips to Florence and Venice. Now at his Newton, Mass., home he is busy with carpentry, painting, and paperhanging. . . . Aileen and **Roy Haeusler** sent us a New Year's greeting enclosing a picture they took of Ruth and myself at the 50th. Thanks, Roy, I hope you will repeat at the 55th. . . . All for now.—**Melvin Castleman**, Secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

33

This is a toughie: a new secretary writing in April, of events in June to be published in July. Bear with us! We hope to say: "Wasn't it a wonderful Reunion! The officers and workers that **Ellis Littmann** picked did a great job. Thanks to all you busy bees."

With a graduating class of about 600 we are expecting about 150 to attend—a goodly crowd. Besides the regulars, a lot of first timers will be on campus and at Chatham Bars. The outstanding feature of this gathering will be the presentation of our 50th Reunion class gift, the largest ever, over $3 million given by one of the highest participating classes on record. **Dayton Clewell, Herb Grier** and **Cy Hapgood** led the effort. There is no way to mention all who helped with this and with the reunion itself.—**Beaumert Whitton**, Acting Secretary, Cottage 112, 5150 Sharon Rd., Charlotte, NC 28210

34

Long range commenting, like forecasting, can be a boobytrap. When I wrote the April notes, we expected to begin our trip in mid-April. Well, departure got pushed back two weeks, so to the people who have written and mentioned hopes that we had a good trip, I will take them as wishes for the near future.

I have an Alumni Fund note from **Harry Heiligenthal** in which he gets somewhat philosophical. He says, "Getting 'older, sicker, and poorer!' It seems all we 'old ones' hear is rhetoric these days—and I am reminded of the old adage, 'The steam that blows the whistle never turns the wheel.' " We can't deny the getting older, but hope the sicker and poorer is relatively insignificant.

There is news of one loss at hand—**B. Russell Franklin**, who died in Venice, Fla. on January 1 of this year. He had received an undergradate degree from Bates and came to M.I.T. to study public health. He received his M.P.H. with us in 1934. Mr. Franklin had been a public health administrator in Philadelphia for 17 years before retiring to Harwich here on the Cape. In 1978 he and his wife Kate moved to Florida. Mr. Franklin is survived by his wife, a son, three daughters, and eight grandchildren. For all of our class I extend our sympathies.

Dr. **Irving Gahm** sends me a fine account by his wife Gudrun of a month's trip they made in February to Tahiti, New Zealand, Australia, the Fiji Islands, and Hawaii. Somewhat condensed, she writes: "Tahiti—Paradise slightly tainted by commercial tourism, but nature's still intact as are the beauty and friendliness of the Tahitians. The island's Gauguin museum makes you realize that the bright feeling of his paintings contrasts with the somewhat sombre facts of his life.

"From the tropical island to the vast continent of Australia, in the throes of a five-year drought which has not subdued the energy, optimism or humor of its people. Sidney is a beautiful and sprawling city, with the harbor approach dominated by the billowing white roofs of the Opera House. The Australian countryside is alive with sheep, even though the drought is taking 1,000 of them every day. The Aborigines are another problem—they've lost their original farming life but not yet managed to adjust to present day society. Not so the Maoris of New Zealand, who have succeeded in preserving their traditions while making their place in the modern world.

"New Zealand is blessed with beauty: rolling green hills, sparkling rivers, steaming hot springs, and soaring mountains. The gardens of New Zealand are spectacular and its proudly independent people a friendly and hospitable lot.

"So are the Fijians who took us on a cruise to one paradise island after another and of course to the Blue Lagoon of Hollywood fame. From the deck of the boat we watched the flying fish soar through the air while schools of tuna fish romped in the ocean.

"And so on to Hawaii, with a memorable tour of Pearl Harbor bringing back memories of December 7, 1941, when George was on duty there as a flight surgeon."

Gudrun has a wonderful closing. She says, "In June we are celebrating our bicentennial, i.e. our house is 100 years old, George is 70 years young, our marriage is ten, and our granddaughter 20!" (Yes, it does add up correctly.)

I've had a nice letter from **Al Rogowski**. He mentions the recent notes about **John Borger** and his work at Pan-American. Mr. Borger lives near Al who called him after reading the *New Yorker* articles by John Newhouse and his following book *The Sporty Game*. They concerned the competition that has gone on over jet aircraft development. I had read the magazine articles but had forgotten that Mr. Borger had been mentioned so frequently in them.

Al also had some information about himself. He is expecting to get up to Cambridge for Class Day, as he did last year, and then visit the Cape and Nantucket. Al and Anita were some of the poor souls who decided to escape winter by going to Florida in February and March. As he says, "Our trip to Deerfield Beach, Fla., this year was marred by a blizzard which left us snowbound for three days in Alexandria, Va., in mid-February while we were visiting Anita's sister. (They don't seem to have many snow plows there!) Upon driving north after four weeks in Florida, including a tour of Cape Canaveral, we ran into a rain storm that was going our way. For four days we'd start in a drizzle, enter the storm, meet torrential rains at its leading edge, tapering off as we unpacked at our next stop. The next days would be a repeat of the previous one. At night my mind's eye saw fast-moving windshield wipers, steadily."

Al added the hope that we'd have better weather on our trip abroad. So do I, but just now things seem to be tough all over. As that is written, we've had a month of rain and gloomy weather. The floods in Louisiana and Mississippi are beginning to subside, the rivers in Germany are flooding. And today I had a letter from friends we will be visiting in southern England. Written April 7, they were still having sleet, hail, and rain—and that after weeks of the same! Well, they've got a month to clean up their act for us.—**Robert M. Franklin**, Secretary, P.O. Box 1147 (620 Satucket Rd.), Brewster, MA 02631; **George G. Ball**, Assistant Secretary, 4601 N. Park Ave., Apt. 711, Chevy Chase, MD 20015

35

Louis "Bud" Pflanz has quickly corrected my error in the April issue in which I gave him an address "where he never lived." Please note his correct address: 3623 Shawnee Dr., Sierra Vista, AZ 85635. He was bragging about getting a sunburn in his back yard while five miles away there was snow at 7,000 to 9,000 feet. (He was at 5,000 feet.) . . . Here are a couple of notes received thru the Alumni Fund Office. From **Fred M. Krause**, "Not yet retired. Left Lummus Co. in 1959, in real estate management business since then. Three children (not children anymore) and seven grandsons. Oldest now 18 and almost ready for college." . . . **George Morrissette**, "Would like to suggest an alumni membership card (wallet size) as a receipt, similar to that used in 1967. We would be proud to carry it. Retired since 1979 from G.E. Have two sons, one grandson, and one granddaughter." . . . From a news clipping: "Sloan School of management's new auditorium in Bldg. E51 has been named the **Charles P. Bowen, Jr.** Hall. Friends and former colleagues at Booz, Allen, and Hamilton, where Charles was chairman, arranged to have the hall dedicated in his memory."

William Bagley is president of Automotive Chemical Corp., Detroit, which he and his wife started in 1970. Mary Lou Bagley was and still is vice-president and treasurer of that company although the couple divorced in 1980. They work in harmony together and the company flourishes. The company manufactures and markets sealers, caulking, and lapping oils to the big three auto companies here and abroad.

I am sorry to have to report to you the loss of three of our classmates. **John J. Ostlund** died in Miami on December 16, 1982. He was a member of the M.I.T. Educational Council. . . . Kenneth Brock, '48, kindly wrote sending me a copy of the obituary of **John Thorpe** who died February 26. John worked at AT&T for 43 years as an engineer. . . . **Paul C. Panagiotakos** died in Lowell, Mass., on February 27, 1982. After earning his S.B. in '35 he continued and received his Ph.D. in chemistry in 1939. He was a professor emeritus at Lowell Technological Institute. I am sending our deepest sympathy to the surviving widows and families.

Written at tax time (April 15), I hope you enjoy a fine summer. Send me a card, send me a letter or just phone me at (617) 647-5208.—**Allan Q. Mowatt**, Secretary, P.O. Box 92, Newton, MA 02195

36

It never fails that notes for the *Review* are due just before an event at which I might see some classmates. This time it is the luncheon meeting for the 50th Reunion Gift Committee. (Ah me!) Still, there are a few items in the mail bag. . . . **Robert Caldwell** keeps busy with paint and coatings manufacturing in Cambridge doing business as California Products Corp. He and Sara took time out for a month in Kenya and South Africa with, of course, a visit to Victoria Falls. . . . Via the grapevine, courtesy of members of the class of '40, I can report that **David Varner** retired from Cushman, Darby, and Cushman, Washington, D.C. last December 31, but is now "counsel" to the firm and has more time for golf and gardening.

Charles Milone writes from Stowe, Ohio: "Since I lost my wife in 1978 I have done litle or nothing that smacks of work. I play a lot of golf in the summer and travel in the winter. I spend six to eight weeks a year in British Columbia with my two kids and their families. I have run into **Roman Ortynsky** a couple of times in Georgia when I visit some friends every year.

Laddie Reday wrote that he and Peg were cross-country skiing in Austria last winter and anticipated a hiking-walking tour in France in June. He sent on a note from **Art Sarvis**, who reports that he and Betty spent a week in Keystone, Colo., with Annabelle and **Chet Meyer** and enjoyed the skiing very much indeed. Art was planning a spring trip to Germany to visit his son who is working on his Ph.D. in history in Koln. They planned to do some sightseeing along with some eating and drinking from Amsterdam to Munich. I hope it all

came off as planned.

Do let me know when you have some news—just plain news, it doesn't have to be spectacular. I have wondered why I was so busy so I sat down and listed my various activities. The number came to 18 with nine charities, and six secretary or treasurer positions, and I enjoy them all!—**Alice H. Kimball**, Secretary, P.O. Box 31, West Hartland, CT 06091

37

Edwin I. Hobson of Cranford, N.J., retired from Aladin in 1982 and started a new career at the Strategic Planning Institute in Cambridge, Mass. He commutes from Rye Beach, N.H., in the summer and from Cranford in the winter. Ed's family are involved in the following activities. Jinny received her Ph.D. in pathology from Vanderbilt University and now has a post-doctorate fellowship at the University of British Columbia in Vancouver. Ted, as assistant attorney general in Vermont, was made responsible for consumer protection and has won numerous settlements. Arch and Pat had a diligent year with Pat pursuing her nursing career as Archer continued his law studies at the University of Maine in Portland. Anne Marie is the stage manager with Joseph Papp's Shakespeare Theatre production of *Hamlet* in New York City.

Susie is a paralegal in a San Francisco law firm. Mary continued her social work, completed a five-month apprenticeship in Phoenix and returned to Orono, Maine for studies toward an advanced degree. Martha designed and developed numerous programs for a software firm in Bar Harbor, Maine. Margy graduated with honors in biology from the University of Virginia and began in September at their medical school. Catie continues her studies toward a degree in English at Colby College. Tommy is in his junior at Hobart College. Paula completed her freshman year and began her first job on the cooperative program at Northeastern University with the Cabot Advertising Agency in Boston.

Ross E. Black of Waterford, Conn., writes, "Still active in QA consulting and SQC Associates committee work." . . . **Conover Fitch, Jr.** of Nahant, Mass., writes, "Have retired from Perry, Dean, Rogers & Partners (after 41 years with that firm). Am now practicing as an individual architect at home and enjoying the seashore with an extended family." . . . At the 102nd annual dinner of the alumni association of the City College of New York **John Lowe III** was awarded the Townsend Harris Medal. The award was established by the Class of 1906 and is given each year to no more than seven alumni who are successful in their chosen field of endeavor. John's field is geotechnical and dam engineering. . . . Rachel and **Albert Shulman**'s daughter, Dr. Sally Shulman, married attorney David Rosengren. She is a fellow in the genetics program at the University of Connecticut Medical Center.

Among other guests, **Leonard Seder, George Rosen, Irwin Sagalyn**, and **Lester Klashman** attended with their wives. Daughter Amy is a teacher and is married to Dr. Robert Weinberg, a professor of biology at the Whitehead Institute, the department of biology at M.I.T. and the Center for Cancer Research. He recently was selected "Scientist of the Year" by *Discover* magazine for his work on cancer research. Son Marc, Ph.D. '69 is the director of cell biology, Rheumatic Disease Unit, in Toronto, Canada. Daughter Justine just received her M.B.A. from Rutgers University of New Jersey. Albert and Rachel have eight grandchildren. Rachel has been to China several times and the last time as a tour leader in 1979. Rachel, an artist presently doing collages, has exhibited in various Connecticut galleries. Albert and Rachel plan to be in England for the month of May 1983.—**Lester M. Klashman**, Assistant Secretary, 198 Maple St., Malden, MA 02148; **Robert H. Thorson**, Secretary, 506 Riverside Ave., Medford, MA 02155

38

By the time you receive this, our 45th Reunion will have become a fond memory. Based on advanced registration, it will be our largest to date, and my prediction, which you will be able to prove or disprove, is that we will have sunshine at Wianno.

Given Brewer recently sold his business, Given Engineering Laboratories, Inc., to Teledyne Engineering Services. Given began the business in Marion, Mass., in 1950, building strain gauges. Thirty-three years later the company had established an international reputation. While Given plans to do more boating, he has a five-year contract as a consultant to the new owners. . . . **Dick Muther** recently had open heart surgery, and, I'm pleased to report, has had a complete recovery. Dick, probably to taper off, announced the transfer of his company's ownership to its present professional staff. Dick started Richard Muther and Associates, Inc. in Kansas City in 1956, as consultants in industrial engineering and management.

Nick Barbarossa couldn't stay completely retired. He writes that he is now a consultant on water resource planning for James City County, Va. (contiguous to colonial Williamsburg). . . . **Bob Bliss** visited **Howie Banzett** at his home in Huntington Beach. . . . **Harold McGillivary** retired from Pittsburgh Testing Lab after 35 years as Tampa district manager. . . . **Frank Gardner** and I went off on a safari in Kenya earlier this year.

Harold Strauss turned over a very interesting letter from **Chung C. Wong** in Hong Kong. C.C. is coming to the States to see his son receive a Ph.D. at Stanford, and was planning if possible to attend the reunion. . . . With regret, we report the death of **Irving Underhill** after a long illness. He is survived by his wife and a brother.—**Armand L. Bruneau, Jr.**, Secretary, 663 Riverview, Chatham, MA 02633

39

Viola and **Hewitt Phillips** of Hampton, Va., recently visited their daughter who designs and makes industrial robots. Hewitt consults with NASA and when at home in Hampton, Va., designs and builds model gliders which can be controlled from hand-held radio transmitters. . . . Billie and **George Cremer**, now both theoretically retired, may be busier than ever before. Recently they completed another cross-country trip including visits to former associates at Los Alamos, and to the **Bob Casselmans** and **Wiley Corls** in Florida. Dotie Casselman reports: "Bob is really a miracle man, working very hard, into music, bridge, and our small church choir. We'll see you all at Reunion 45." Wiley Corl, also in retirement, is surviving pleasantly in the "Southeastern Garden Spot of the Universe," otherwise known as Boca Raton. After George and Billie touch bases here with six children and many grandchildren, they'll depart again for new travels, this time possibly including Rumania.

John Cushnie is in Chestnut Hill, Pa., enjoying retirement from a chemical engineering career with Catalytic, Inc. John divides time between "Town Watch" activities in his neighborhood and vacationing at nearby Atlantic Ocean beaches. . . . **H. Kendall Raymond** started in Course V. Last month he retired after 20 years with Bennett-Nawman, Inc., supplier of telephone enclosures. For the last six years he was international sales manager. It would have been helpful if my news source had included the interesting detail about how Ken got from chemistry to international phone booths.

Seymour Heymann retired from Signode Corp. to manage his country home north of Fort Collins in summer and to ski cross-country in winter. Between seasons he is exploring acquisition of a personal computer. (Seymour, 16 months ago I bought a first-class personal computer having million-byte capacity. I became stimulated and challenged to program it to monitor investments. If you can manage your skis to bring you westward to La Jolla, I'll show you one man's application of his personal computer.) . . . We are saddened by news of the death on December 31, 1982 of **Robert J. Davidson**. There were no details.—**Hal Seykota**, Secretary, 1603 Calle de Primra, La Jolla, CA 92037

40

Our class treasurer, **Ed Bernard**, reports on our annual membership solicitation as of March 1. This year's mailing included adjacent countries of Canada and Mexico and the commonwealth of Puerto Rico. Other foreign countries were not included. Out of 655 invoices mailed, 221 paid for 1982-83; 19 paid in advance (1983-84); 13 paid in advance (1984-85); and one paid in advance (1985-86). Present receipts reflect a membership rate of 34 percent of those contacted.

In addition to his class treasurer's activities, Ed has had an exciting, challenging, and stimulating time as regional management analyst at E.P.A. for the past few years. He reports that marching orders have included such directions as reducing size and budget by 40 percent in four years. . . . but, no firing permitted. Influence states to accept E.P.A. mandated authorities and carry out enforcement activities . . . alleged polluters will be handled with a spirit of cooperation and compromise. Confrontation is OUT. Increase effectiveness and productivity of regional operations, but centralize decision making in Washington. The continuing flow of bureaucratic management directives rarely permits a dull day!

John Casey is now executive vice-president of operations at Pan American World Airways in New York. He sent a lead on the whereabouts of **William H. Stone**. Unfortunately, it didn't pay off. Thanks anyway, John.

A note received from the Alumni Office indicated that **Robert Levis** died of an aneurysm on September 25, 1982. He had been chairman of the board of the Levis Land Co., 710 First National Bank Bldg. in Alton, Ill. He is survived by his wife, Elizabeth, who is running the operation known as Bluffdale Farms, Inc. This business is primarily raising grain in Wyoming. The cattle ranch in South Dakota was sold. She is a director of Washington University in St. Louis and intends to maintain the office in Alton. . . . **C. Gordon Livingston** writes that he is still active in the aircraft industry as vice-president of Wing Aircraft Co. in Torrance, Calif.

Bill McDonald dropped a line to say that since he had been listed among the lost members he had better inform us of his recent acitivities. Bill moved from Massachusetts to 2754 Angell Ave., San Diego, CA 92122, in 1979. He is still working, currently as an engineer for a manufacturer of personal computers and enjoying the comfortable California climate.

A note from **Daniel Puffer** indicates that he has retired from General Electric Co. as manager of the Thomson Laboratory. He and his lovely wife live in North Andover, Mass. His son is married and teaching in Lima, Peru. Daughter is a registered hydrologist in Juneau, Alaska. Dan has started a new career as an artist. Hope he will show his paintings at our 45th.

Do you have an interesting hobby to tell us about? Perhaps you, too, will be able to display your handiwork at this big reunion.

Received a mysterious note. No name, postmarked Marina Del Rey. The return address was P.O. Box 271, and PVE 90274. The info contained therein was the address of **Alfred P. Barton**, which is P.O. Box 193, Middleburg, VA 22117. Thank you . . . whoever you are . . . please identify yourself!

If your name has not appeared in this column, it is your turn to tell us about your activities. Please let me hear from you.—**Donald R. Erb**, Secretary, 10 Sherbrooke Dr., Dover, MA 02030, (617) 785-0540

42

We have a very interesting report from Zelda and **Bernie Levere** about their recent trip to Southeast Asia. Bernie writes, "Our first stop was Taiwan, then the Philippines where the ancient rice terraces in Banaue are the eighth wonder of the world and the Muslim villages in Zamboanga very colorful; then Malaysia where we spent a night among former head hunters in Borneo; Thailand at the best hotel in the world, The Oriental in Bangkok, and several days in the Golden Triangle where Laos, Burma, and Thailand meet. Then we spent eight days in Burma where the wonders of Rangoon, Mandalay, and especially Pagan were fascinating. Pagan at one time had 6,000 gilded pagodas and temples over an 11-square-mile area. And finally southern India with its beautiful beaches, interesting synagogue in Cochin, and outstanding temples in Madura and Tanjore."

Bernie shot 112 rolls of color film and asks us to tell **Jim Littwitz** about the consumption since it was all Kodachrome 64. Some of Bernie's prints are now on display at the Teaneck Public Library for a six-month run. Any of you in northern Jersey might go over and take a look at them.

Just a little other news this month. **Fran Staszesky** retired on January 31 having served as president and chief operating officer of the Boston Edison Co. . . . **Bill Tallman** was promoted to chairman of the Public Service Co. of New Hampshire. . . . **Will Yocom** retired from Bell Laboratories after "an enjoyable career working on a wide variety of tasks from Tantalum integrated circuits to microwave tubes ending up leading a group designing microwave integrated amplifyers for digital radio systems."

Let's have some news or I will, again, have to send out one of our handi-dandi mailings with forms for news or will start fabricating these notes myself. Beware!—**Ken Rosett**, Secretary, 191 Albemarle Rd., White Plains, NY 10605

43

It is April 8 (as I write our column) with a temperature of 48 degrees in Tulsa, rain, and a possibility of snow. I am ready to ask for a refund on my Okie button. Furthermore, the monthly envelope from the *Review* contained no news, while the other mail provided only a single letter, from **Sid Atlas**. Sid is located some place in Harris County, Tex.—Houston, I believe it's called. He is president of Atlas Air Conditioning Co. (Houston is arguably the air conditioning capital of the galaxy.) After 35 years he is about to turn the business over to his two sons, but he plans to continue as a part-time consultant to the firm, although his major interest will shift to travel, golf, and other retirement-type activities. In addition to Sid, the Atlas family presently consists of a wife, four children, five current grandchildren, and two prospective ones. Sid says he's in good health, except for a bad back and has actually lost some weight since graduation. His parting cry was, "See y'all in June."

After five fruitless phone calls to other class members in various parts of the country, I finally talked to **Harold Rosoff** in Phoenix. Harold has been with Greyhound since 1969, rising to become vice-president of the Armour food processing operation. More recently, he has taken on the jobs of vice-president for environment and energy and chairman of Greyhound's investment committee. Harold has also served on the M.I.T. Corporation Development Committee. He says his current position involves a lot of travel. (Those long bus rides are murder.) The Rosoffs have lived in Phoenix for the past 12 years. The three children are now well established on their own, leaving Harold with the time to pursue two other interests, exploring Arizona's Grand Canyon and rafting on the Colorado River.

Your secretary is pleased to report the birth of a third grandchild, a girl, in Seattle. With a little talent and luck she might be third generation M.I.T.—**Bob Rorschach**, Secretary, 2544 S. Norfolk, Tulsa, OK 74114

44

Fiesta: Two years ago when our class planned a mini-reunion at the 33rd M.I.T. Fiesta in Mexico, a total of 17 '44ers participated. This year, with no fanfare, we again constituted the largest number of class attendees at the 35th Fiesta. Bobbie and **Burt Bromfield**, Janice Kispert, Marge and **Sam Lamport**, **Peter Matthews**, Elvira and **Arturo Morales**, Ruth and **Norm Sebell**, **Melissa Teixeira**, and Marcene and **George Ziegler** enjoyed the festivities in Mexico City and Oaxaca.

Flap Facts: **Alan W. Dunwiddie, Jr.** notes that he is "president and executive director of Janesville Foundation, Inc., a private foundation created by gifts of the Parker Pen Co. and others in 1944. The principal activities are confined to charitable organizations serving the Janesville, Wis. area." He is also president of the Janesville Industrial Development, Inc.

Condolences: The widow of **Nicholas Glyptis** writes of the death of her husband on July 30, 1982. He had been the president and chief scientist of Glyptis Scientific, Inc. in Addison, Ill. We send our sympathies to his widow and family.

40th Reunion: Joe Martori of the Alumni Association staff met in April with Anita and **Les Brindis**, **Andy Corry** and guest Janice Kispert, Ruth Sebell, **Melissa Teixeira**, and Edna and **Stan Warshaw** at the home of Jane and **Lou Demarkles**. Reunion activities will be on the M.I.T. campus on June 7-8 with a Saturday morning departure for a surprise New England resort from Saturday through Tuesday. Details will be revealed in the next class notes. . . . Have a busy and happy summer!—**Melissa Teixeira**, Secretary, 92 Webster Park, West Newton, MA 02165.

46

Hey! Somebody out there *was* listening. My monthly plea for information was heeded by **Chuck Wellard** who sent me a swell note the end of March. A Course VIer, Chuck went on to get an M.S. at Carnegie Tech in 1947 and then on to form the American Components Inc. (ACI), opening factories in Europe and the Far East before selling ACI to Insilco in 1968. He is presently president and chairman of a group of Insilco companies, known as Computer Circuitry Group, devoted to products for the computer industry. Sounds like he's going out a winner, planning an early (and I'm sure comfortable) retirement next year. About the only classmate he's kept in touch with is his old roomie, **Bud Brylawski**, though he did reune with SAE frat mates at Hilton Head about a year ago. Chuck, living now in the Raleigh, N.C. area, sends best wishes to all the fellows.

Sifting through a raft of material received from prez **Jim Goldstein** in early March, I see that an ex-"neighbor" of Jim's, **Gerome Gordon**, has retired and is now living on John's Island, S.C.—2395 Hammock Rd., 29455, to be exact. Drop him a line.

And lo, the lost are found. A year ago I put out a "search warrant" for old roommate, **Mario Vinci**, who had seemingly fallen off the end of the earth some 20 years ago. Fortunately he saw my byline in the alumni notes back in February and wrote me a quick note encapsulating a 21-year odyssey. Seems he used his Course II degree and one in industrial engineering from Southern California to forward a career with Aerojet General in electromechanical design management.

After a broken marriage in 1970, he went on an assignment in 1975 to Australia where he met and married Christine ("an Aussie") in 1980. Shortly thereafter he returned to California where he is now living in Newport Beach. But the remarkable coincidence, discovered in subsequent notes and phone calls, is that he had only recently been working on a project in a building right across the parking lot from where I work, in Buckley Field. Aurora!! If you'd like his address/phone, drop me a line.—**Jim Ray**, 2520 S. Ivanhoe Pl., Denver, CO 80222

48

These notes are being written from the Panorama Hotel in Katmandu, Nepal. (Please excuse the absence of the regular class news). The hotel building was owned by the Rana family until 1951 when the king deposed the Ranas who had managed to control the country for 104 years.

Flying from New Delhi the first view of Annapurna and the Himalaya is as dramatic as all the photographs you have ever seen. Descending to Katmandu in a valley, the pilot squeezed the Boeing 737 through a pass between the lying mountains.

My daughter Amy, who spent a month in New Delhi, India, as part of her medical training, and I will trek to Kala Pattar (black rock), a hill of rocks (at 18,500 feet) about two miles from the summit of Mt. Everest. We plan to sleep in huts operated by Sherpas and buy our meals at the many tea houses. The highest hut at Gorak Shep (16,240 feet) has a capacity of only 12 people, but we hope to stay there at least one of the two night in that area. This is not a wilderness trek. The trails are well developed, and 5,000 people visit the region every year. There are about 2,000 native Sherpas in the area who have been porters for generations. In earlier years they carried Chinese and Tibetan goods through high passes in the Himalayas towards India and to other trading routes.

Next month's column will report what we achieve. Also I have interesting news from **Bill Zimmerman**, **Bernie Gordon**, and **Graham Sterling**.—**Marty Billett**, Secretary, 16 Greenwood Ave., Barrington, RI 02806

49

Len Newton and his wife Ruby will be guiding a deluxe and wonderful-sounding tour of China in October. Information can be obtained from the M.I.T. Quarter Century Club. . . . **Tom Whitlow** couldn't stay retired and quiet. After one year of travel and ease, he has returned to school taking courses in both real estate and accounting. . . . **Dave Tod** is involved with the Commuter Aircraft Corp. in his hometown of Youngstown, Ohio. He has been chairman, CEO, and a director of the company. . . . **Bob Hughes** writes in to cast his vote for Bermuda for the 35th.

The 35th Reunion, June 1984, will be either at the Wychmere Harbor Club on Cape Cod or at the Inverurie Hotel in Bermuda. Good prices and excellent arrangements have been assured at both places. A mailing was sent to all of you last April asking for your choice and for class dues to finance class mailings and preliminary arrangements. Both locations sound wonderful as a follow-up to campus activities on Thursday and Friday of Technology Day. Thirty-five years—it's been a long time, baby.

Incidentally, **Fletcher Eaton**, our class historian, is looking for photos and memorabilia of past reunions, class activities, and undergrad doings. Send them to me, and I'll forward them to Fletch.—**Paul E. Weamer**, Secretary, 331 Ridge Meadow Dr., Chesterfield, MO 63017

50

Robert S. Berg is still with Lincoln Labs working on another communication satellite. His daughter is at the University of Rhode Island and Bob's wife, Anne, is finishing her second year as chairman of the M.I.T. Women's League and enjoying M.I.T. student friendships through MITWL's Hosts for International Students program. . . . **Robert A.**

Pucel is presently a consulting scientist at Raytheon in Waltham, Mass. On March 17, he lectured on "Monolithic Microwave Circuits: Why All the Excitement?" at Raytheon's new research laboratory in Lexington. Pucel is a co-recipient of the 1976 Microwave Prize granted by the MTT Society and is a fellow of the IEEE. He also was the national lecturer for the Microwave Theory and Technique Society for 1980-81. In this role he lectured in the U.S., Canada, Europe, the Middle East and Asia, including the People's Republic of China.

Harry G. Foden, industrial development expert for Arthur D. Little, Inc., recently published an article in the *Annual Investment File*, a business journal published in Great Britain. He advises industrial developers to pay attention to companies nearby for likely growth prospects, since their growth can account for most of an area's employment and investment growth. Harry notes that the smaller company with 50 to 100 employees is most likely to be involved in expansion. He cites recent studies of employment in a midwestern state which found that during a six-year period, more than half of all new jobs in the state came from expansion of small local firms.

It is with sadness that we announce the death of **Robert J. Sullivan**. Bob died on February 3, 1983. He was manager of international purchasing for the Gillette Co. in Boston, a position he had held for 12 years. He started at Gillette Co. in 1950 as a production supervisor and traveled widely, going to Brazil as a manager in 1959, and then to Australia in 1961. He moved to Sherborn in 1969. He leaves his wife Barbara, two sons, and a daughter.—**John T. McKenna**, Secretary, 1 Emerson Pl., Boston, MA 02114

51

The Center of Energy Studies at the University of Texas, which is headed by **Herbert W. Woodson**, has started construction on a new $12.6 million building. Dr. Woodson announces, "Until now, the Center for Energy Studies has concentrated on stimulating research by faculty members and students within the traditional academic departments. Now research will be carried on by faculty and students augmented by full-time researchers." . . . **Carl Liswith** reports that he was transferred by IBM to Tampa, Fl., in 1981. He continues to enjoy working for IBM after 27 years. He's also enjoying the sun, surf, and life in beautiful Florida.—**Gregor J. Gentleman**, Secretary, 818 Southwest Ninth St., Des Moines, IA 50309

52

We are indebted to **Art Turner** for a clipping from the *New York Times*, February 27, recounting the views of **H. Stephen Spacil** on CAD, CAM, and CAE. As we are all supposed to know nowadays, these initials stand for computer aided design, manufacture and engineering. Steve is General Electric's scientific observer in Tokyo. He notes that CAE is the developing art, and although it is primarily software, in which America holds an edge, the Japanese should not be underestimated as potential competitors. He says, "The real strength of Japan is in its management flexibility, the ability to take a new manufacturing concept and run with it. That may enable Japanese companies to move very quickly into advanced factory automation."

William F. Hoey writes that he presently has his own business as a transportation engineer, and also teaches transportation planning at California State Polytechnic University in Pomona. Presumably he has a computer to aid him.

Have a pleasant summer.—**Richard F. Lacey**, Secretary, 2340 Cowper St., Palo Alto, CA 94301

54

John Pierce is director of the underwater acoustics program at Signatron in Lexington, Mass. His older daughter is a sophomore at Harvard, and his younger daughter is a high school senior. . . . Congratulations to **Martin Brilliant**, who received a "Distinguished Technical Staff" award from Bell Laboratories. . . . **Nicholas Markoff** is working in database administration for IBM in Harrison, N.Y. . . . Business is booming for **Raymond Mintz**, who has one of the most unusual occupations we've seen. Ray is director of the Research and Development Division of the U.S. Customs Service. He is responsible for new devices and systems to detect concealed contraband and illegal border crossings.

Don't buy another 43-foot Cat Ketch without contacting **John Reiman**. John's boats, available from his company, Stay Free Yachts, feature carbon fiber masts. John, a transplanted midwesterner who was born in Indiana, was captain of our varsity sailing team.

On a sad note, we report the death of **Richard Eaton** in Exeter, N.H. on January 9. Richard, who served as a second lieutenant in the Korean war, was a program manager at Raytheon Corp. We extend our condolences to his wife Beverly and to their two sons Richard and Christopher.

—Secretaries: **William Combs**, 120 West Newton St., Boston, MA 02118; **John Kiley**, 7 Kensington Rd., Woburn, MA 01801; **Louis Mahoney**, 52 Symor Dr., Convent Station, NJ 07961; **Dominick A. Sama**, 28 Chestnut Hill Rd., Groton, MA 01450

56

Warren G. Briggs, professor of management at Suffolk University, was the distinguished guest lecturer for the annual faculty development seminar at the National Defense University in Washington D.C. this past October. He reviewed recent trends and computer-based materials for teaching quantitative methods and decision support. In November Warren chaired a conference in New York on evaluating decision support software, and also served as discussant at the November meeting of the New England Business and Economic Conference in Springfield, Mass. . . . **Ellen Harland** writes: "Am in my sixth year of private architectural practice currently serving as president of the Santa Fe, N.M., chapter of the American Institute of Architects. As an educational counselor I'm enjoying interviewing prospective M.I.T. students. My license plate on my Rabbitt is MIT 56." . . . **Ronald C. Clark** has been promoted from vice-president and fund manager to executive vice-president of the Putnam Companies. . . . **Richard L. Peskin** is director of the Laboratory for Numerical Fluid Dynamics and professor of mechanical and aerospace engineering at Rutgers. Richard is also vice-president of Logos Information Systems, a new company devoted to scientific and engineering applications for the new generation of high performance microcomputers. . . . **Fred B. Bialek** is president of Onyx and IMI, a manufacturer of Winchester disk drives and microcomputers. He was previously vice-president in charge of three divisions at National Semiconductor.

Charles R. Greene, Jr. and his wife Barbara have lived in Santa Barbara, Calif., for 20 years, "a fine place from which to do arctic research." Their first son Doug graduated from Princeton, son Scott is a senior at Brown. Charlie, for the past three years has spent August on the Beaufort Sea making various noise measurements in conjunction with studies of barhead whale behavior. In 1982 he spent a week at Admiralty Inlet on Baffin Island recording sounds from narwhales and from an ice breaking ore carrier. He also made several trips to Prudhoe Bay to record the sounds of construction while a gravel island was built three miles off shore. Charlie also mentioned that he returned in January from a week at a phoneless, TV-less, 120 vac-less resort where a meeting was held by the Minerals Management Service. Charlie and Barbara love cycling and traveled in this fashion over quite a bit of central Colorado and also in Vermont.

Robert W. Mann, '50, *who's been widely honored for his contributions to bioengineering and the applications of engineering in the service of the disabled, is now honored in a new arena: he's to be president for 1983-84 of the M.I.T. Alumni Association. Joe F. Moore, '52, of Houston, chairman of the Selection Committee, says the choice recognizes Professor Mann's long-time commitment to helping keep alumni abreast of M.I.T. developments and his "lengthy and extensive involvement in alumni governance" as a member of the Association's Board of Directors and Alumni Fund Board.*

Keep the mail coming. I love to pour over the Atlas as I read the work being done and the travel. Your Western correspondent is writing this after a rest, graciously provided by Robert while we grieved the loss of our oldest son. Russell, 20 years old, died on June 13, 1982, when he fell from the Flatirons in Boulder, Colo. He had just finished his third year at M.I.T.—Co-secretaries: **Caroline Disario Chihoski**, 2116 W. Davies Ave., Littleton, CO 80120, (303) 794-5815; **Robert Kaiser**, 12 Glengarry, Winchester, MA 01890, (617) 729-5345

57

The public affairs department of the Methodist Hospital in St. Louis Park, Minn., announces that **Charles L. Murray** has been elected secretary-treasurer of the hospital's 529-member medical staff. Dr. Murray is a specialist in cancer care and treatment. He is an associate clinical professor with the University of Minnesota and is also medical director of oncology at Methodist Hospital. . . . **Philip Presser** writes that he has completed his first marathon at age 46. . . . **Walter Gowen** returned to the United States from Venezuela in December 1982. This was his second trip to Venezuela, and it lasted for three years.

Lee and **Charles Lingle** have moved to Her-

mosa Beach, concurrent with his moving from JPL to Northrop Electronics. . . . **John Spencer** is a sales representative in the building maintenance products field and also an applicator of roofing and paving coatings. He is planning a July trip to the Northwest with a van full of Boy Scouts to visit the World Jamboree in Calgary, Alberta.

Jay Holladay sends greetings to all in the Class of '57—he's sorry he couldn't make it to the 25th Reunion. Jay was involved in the launch of the Infrared Astronomical Satellite which took off from Vandenburg Air Force Base last January 25. The satellite has been returning good data that the astronomers are very excited about. In his spare time Jay serves as division director of the American Radio Relay League, the national organization of amateur radio operators.—**Vivian Warren**, Secretary, 156 Northrop Rd., Woodbridge, CT 06525

58

With the 25th Reunion festivities over (by the time you read this), we are now looking forward to the red blazers of the 50th—and to a few more happy reunions in between. All indications at this writing in May point toward an exceptionally good turnout for the 25th.

If all you know of Toledo is what you heard from Klinger on M*A*S*H, then you should see the new SeaGate Center. A few weeks ago, I visited with **Paul Rothschild**, a vice-president of Owens-Illinois headquartered in a gleaming blue-green 32-story tower in the center overlooking the river. Paul is responsible for international operations of the O-I Plastics and Closures Group. And by the way, since I spend a lot of time in Toledo on management consulting assignments, I can heartily recommend the city's wide range of good restaurants.

Also visited recently with Beth and **Al Russell**, who have built a new country home in Amherst, Mass. Al is on a sabbatical from the University of Massachusetts, and working for Digital Equipment Corp. In their spare time, they have been becoming masters of terpsichore, and they promised to dazzle us at the reunion. . . . Perceptive readers of *Scientific American* probably caught the article co-authored by **Vic Teplitz** in the March 1983 issue. A cosmological forecast of events through the year 10100, the article is entitled, "The Future of the Universe." Vic is currently deputy chief of the Strategic Affairs Division of the U.S. Arms Control and Disarmament Agency, and also serves as adjunct professor of physics at the University of Maryland. In 1979, Vic served as an advisor to the U.S. delegation at the second and third sessions of the negotiations on anti-satellite weapons between the U.S. and the U.S.S.R.—**Michael E. Brose**, Secretary, 59 Rutland Square, Boston, MA 02118

59

The first weekend in April my wife and I took our children to visit Epcot Center in Disney World. The warm weather was nice, but Epcot was really not very interesting.

The following news of classmates is sent by **Adul Pinsuvana**. He writes, "**M.S.A. Sastroamidjojo**, is now head of the Department of Solid State Physics and the Solar Energy Department at Gadjah Mada University in Yogyakarta, Indonesia. M.S.A. got his M.Sc.E. from UCLA and his Ph.D. from the Australian National University in Canberra. Even though he lives very close to me in Indonesia, after six years in Jakarta I have yet to meet him. I will definitely see him next month and will report more on him. He can be contacted at Solar Energy Research Center, Universitas Gadjah Mada, Sekip Unit III, Bulak Sumur Yodyakarta, Indonesia Telex 25135 UGM Yogyawkarta. . . . **Narindar S. Saluja** (Rama Enterprises, 285/15 Silom Road, G.P.O. Box 2600, Bangkok, Thailand) and his wife have now been in Bangkok more years than I. I have been out of Bangkok for a total of nine years, while Narindar has been in Thailand continuously since the early sixties. He will probably attend our reunion even though he said (in October 1982) that 1984 sounded like eons away." . . . Adul can be reached at: Jalan Kartanegara 72, Block Q, Kebayoran Baru, Indonesia.

I regret to inform our classmates of the death of **Dimitri D. Afonsky**. Apparently the news of his passing, in September 1980, did not reach the Institute until recently. Dimitri had been with Hughes Aircraft Systems International in Brussels, Belgium. . . . **Lou Cohen** is Digital Equipment Corp.'s software quality consultant, where he has been for the last 12 years. I am sure that any of you who have been involved with the purchasing of computer software know how difficult it is to find people who can do the job right. Certainly any efforts on Lou's part are appreciated by the world at large. . . . **James Robertson** has recently become chairman of the mathematics department at the University of California at Santa Barbara, and we wish him good luck. . . . **John Kusmiss** has been working for the last few years at the University of Southern California Institute for Physics and Imaging Science (part of the USC medical school) doing research in solid state radiation detectors (mercuric iodide). I have no idea what his research actually pertains to and I hope he will drop me a line explaining a little bit more about it.

From Cambridge, **G. Neil Harper** advises that his company, Harper and Shuman, Inc., now ten years old, has 60 employees and is continuing to perform computer consulting work. . . . **Oscar L. Morgenstern** has been promoted to associated technical director of transportation systems engineering at the Mitre Corp.'s Metrik Division in McLean, Va. Oscar has been at Mitre since 1959. . . . **Allan V. Oppenheim** has recently published a book, *Signals and Systems*, with Allan S. Woolsky, '69, and Ian T. Young, '65.

Although it is more than a year away, I hope that all class members will begin planning for the 25th Reunion. I am eagerly looking forward to it, and I hope to see all of you there. I also hope every one of us will attempt to make our 25th year the biggest year for contributions to the alumni fund.—**George L. Barnett**, Acting Secretary, 90 Broad Street, New York, NY 10004

61

A few weeks ago I got a sad letter from Reginald Bisson, '30, telling of **Charlie George**'s death in a one-car accident on March 24. Mr. Bisson wrote that Charlie was a remarkable man. He was prominent in his community, and an avid blue water sailor. Charlie was a member of President Reagan's task force on federal construction and was the president of the Northern New England Chapter of Associated Builders and Contractors. He was president of G2S Constructors in New Hampshire. In a tribute to Charlie in the *Laconia Evening Citizen* the local superintendent of schools said that Charlie was a great listener and leader of the school committee to which he had been elected four years previously. I know we all send our deep condolences and regrets to his wife, Susan, his two daughters, Heather and Jennifer, and his three sons, Geofrey, Charles, and John. It was Charlie's wish to be buried at sea.

Tom Hastings writes that he has been busy for the last year chairing the ANSI standards committee developing a videotext/teletext standard. He hopes that this will become the new electronic medium of communications. His daughter, Jessica, is now a year and a half old and "a real delight." . . . **Omar Prewett** writes that he is associate professor of physics at Gustavus Adolphous College where he teaches both physics and linguistics. He just returned from Japan where he spent the last year as an exchange professor at Kansai Gaidai University in Hokido. He spent the year teaching English to Japanese students.

There was an interesting article in the Quincy, Mass., *Patriot Ledger* about **Rob Fisher**. (Also see *Technology Review*, April 1983, pp. B16-B17.) Rob was an industrial designer who has turned, full time, to sculpture. And what sculpture it is! He makes huge hanging constructions containing various metals and dozens of lights. You gamblers may have seen his "Northern Lights" in the Atlantic City Playboy Club or a five-piece fountain in Philadelphia. The occasion of the Quincy article was a commission to fill the atrium in a south shore bank. The picture of the work was spectacular.

Dick Resch is president, treasurer, and chief executive officer of Krueger Holdings, Inc., of Green Bay, Wis. Holy smokes! Are there any other jobs left? Krueger makes furniture. On the side, Dick seems to be running the local YMCA, sits on the M.I.T. Educational Council, is a director and treasurer of a local hospital, and occasionally sees wife Nancy and their four children. Whew!—**Andrew Braun**, Secretary, 464 Heath St., Chestnut Hill, MA 02164.

62

Robert E. Anderson is now vice-president, corporate marketing for GenRad, Inc. He is in Phoenix, where the company has two divisions as a result of its 1980 acquisition of Omnicorp, Inc., a company that Bob founded. He and his wife Judy have two children, Beth (14) and Greg (12). . . . **Douglas Cassell** writes that his latest book *Microcomputers and Modern Control Engineering* has just been published by Reston Publishing Co. He is now vice-president, engineering at Inconix Corp. in Natick, Mass. . . . **Scott Danielson** is principal architect for the western region of Parsons, Brinckerhoff, Quade, and Douglas—engineers, architects and planners. Recent projects include a $5 million transit center in San Diego, a museum in Ukiah, Calif., and light-rail systems in San Jose, Portland, and Denver. He is also a consultant for tunnels in Colorado and a bridge in Seattle.

Congratulations to **Martin Klein** who was selected "Small Business Person of the Year" by the State of New Hampshire. Regular readers of this column know that Marty's company, Klein Associates, specializes in undersea search and survey equipment such as sonar and related technologies. . . . **Earl R. Ruiter** is this year's president of the M.I.T. Student House, Inc., a group of alumni who provide a cooperative living group for M.I.T. students with financial needs. . . . **Donald L. Smith** reports that he has a new assignment at Honeywell as technical director of corporate design automation. He and his family continue to live in the Boston area. . . . **Edward W. Underriner** has been named director of technical resources for the Food Service Division of McCormick and Co. The new job relates to development, production, and marketing of frozen food products.—**John E. Prussing**, Secretary, 2106 Grange Dr., Urbana, IL 61801

63

Well, I thought my term of office was over, but it appears that I owe you one last column. And here it is. **Steve Kaufman** writes that he left the Midland Ross Corp. to move to New York as president of the Electronics Distribution Division of Arrow Electronics and vice-president of the parent corporation. . . . **Elliot Koffman** spent a year as a visiting professor of engineering at Swarthmore College and is now back in the Department of Computer and Information Science at Temple University. He is working on a new textbook (his seventh) for Addison-Wesley entitled *Problem Solving and Structured Programming in BASIC-Plus* due to be published in December 1983. Elliot's oldest child is in his freshman year at Wesleyan. . . . **Ken Klein** has moved from San Francisco to Atlanta, and is now working for Cox Data Services as a product manager. Cox designs

computer systems for television stations. . . . **Ron Jansen** and his wife **Chris Huk** wrote to say they lead busy lives. To quote the note, "Two careers plus two children is a great experience, if you live through it." Amen, I know the feeling. . . . **Alan Schwartz** would like to know if anyone is interested in organizing an Alpha Phi Omega reunion for 1984? (A dangerous questions, Alan—you know what happens to people who ask questions like that.)

Larry Beckreck writes that he is now the manager of Leicester (U.K.) Itec, running a training center for young unemployed people with "poor grades" in high school in England. The center teaches computer use and repair and basic electronic techniques and places its students in industrial jobs after a year. Larry's wife Julia is still teaching 8-9 year olds in a state school. Sons Seth, 14, and Joshua, 13, are enjoying school, scouts, drums, etc. . . . **John Hornstein** reports that his wife Julie went back to school and recently graduated with a degree in interior design. John is still at Computer Sciences Corp., working with the Goddard Space Flight Center to study atmospheres in the far infrared. The focus in these studies is switching from Jupiter and Saturn to Uranus and Neptune, and the Earth's stratosphere. John must be enjoying his work, because he closes with the question, "They pay me to do this?"

Finally, a few press releases round out this communication. **Maurice Andrien** has been appointed president and chief executive officer of Superior Electric Co. of Bristol, Conn. Maurice had been vice-president of Kaman Corp's music group. . . . **Jon Clemens** was appointed staff vice-president of consumer electronics research, at RCA Laboratories in Princeton, N.J. Jon is responsible for research on digital products, television, and VideoDisc systems. Jon has been with RCA since 1965. . . . **Richard Harris** is now associate technical director of the Naval Systems Engineering Division at the MITRE Corp.'s Washington C3I Operations in McLean, Va. He is responsible for command and control systems engineering for Navy and Marine Corps projects. Richard joined MITRE in 1968. . . . Well, that's really the end. Good luck to the new secretary—keep him or her supplied with notes. It's been fun.—**Mike Bertin**, Secretary, 18022 Gillman St., Irvine, CA 92715

64

Congratulations to us!—the class of '64. This month, for a refreshing change, we received a wealth of news. Keep up the good work!

Carl Uhrmacher petitions us to publish the following: "The time for our 20th Reunion is fast approaching. As class officer in charge, I find it impossible to coordinate a reunion in the Boston/Cambridge area without volunteer help. Accordingly, we need a volunteer (preferably local to the Boston area), to set up Boston-based arrangements. If we can't get a volunteer, we may be forced to hold our reunion in the Baltimore/Washington area." Please write Carl at Carltech Associates, Inc., P.O. Box 1158, Columbia, MD 21044 or, preferably, call him at (301) 997-5155. Thanks, and remember, a successful reunion is the joint responsibility of all of us! . . . **Ron Gilman**, '64's first secretary, was recently elected treasurer of the Memphis and Shelby County Bar Association. The Schlossers thank the Gilmans for doing this job for ten years!! All volunteers please step forward at our 20th!!

A news release from Owens-Corning Fiberglas Corp. in Toledo, Ohio, announces the promotion of **Robert H. Beck** to general manager, FRP Components Division. He will have responsibility for manufacturing and marketing the company's line of glass fiber-reinforced bathing components.

The following news comes from alumni fund envelopes. They help M.I.T. sooo much; please keep them coming! . . . **Mark Alpert** was named the LaQuinta Motor Inns, Inc. centennial professor of business administration, at the University of Texas at Austin. His wife Judy is an adjunct professor of business at St. Edwards University, Austin, Tex. . . . In February, **Michael Auerbach** was promoted to assistant research and development director, Specialty Chemical, Pfizer Central Research. He guest lectured on seawater desalination at Columbia University last July and at Fairleigh Dickenson University's St. Croix Lab in October. . . . Lieutenant colonel **Joseph Boling** is enrolled in a crash course in Japanese at the language school in Monterey, Calif., in preparation for a ten month tour at the Japanese National Defense College. Afterward, Joe expects a three-year assignment at one of the major headquarters in Japan. . . . **Thomas B. Cheek** is a cofounder of XYVISION, a company formed just this past year. He is vice-president of engineering for the company, which makes computerized publishing systems.

Jeff Friedberg's investment management business is going very well. Jeff offers a "semi-intelligent opinion of IRAs, stocks, interest rates, etc." To speak to him call (713) 777-2100. How's that for an advertising plug! In case you didn't know, as I didn't, 713 is a Texas area code. . . . **Eric Greenwell** is working for Battelle Memorial Laboratories in Richland, Wash. His son has just graduated from chef school, and his wife Jan is a self-employed potter. In his spare time, Eric flies and competes in sailplanes. . . . **Richard W. Kline** is manager of development for the wire and cable division of ALCAN Aluminum in Williamsport, Pa. Formerly, he was with W.R. Grace Co. and had been a Spartanburg, S.C. city councilman before accepting this position. . . . **Mark Lappin** writes that he and **Gary Walpert** are partners in the recently formed Boston-based law firm of Lahive and Cockfield. . . . **Mike Monsler** says he enjoys reading the class notes; well, hey Mike, how about some news?

And from **Carl Uhrmacher**, our 20th Reunion Chairman: "We have been very lucky. In response to our letter several interested classmates stepped forward; our reunion will be in the Boston area June 7-10, 1984. Now that I have been relieved of Boston-based duties, I would like to be made busy elsewhere. We would like to have mini-reunions in your local area for classmates who can not make it to Boston or those who want something additional. If any of you would like to coordinate a mini-reunion in your area, please call me at (301) 997-5155 (before 6 p.m.) or at (301) 730-9152 (after 6 p.m.). Also, please heed any requests for class dues or contributions, since I am also class officer in charge of spending reunion money. . . . See you in Boston."

We survived the great blizzard of 1983 (February 11-13) which, in expected fashion, closed down the Greater Washington, D.C., area for two days and generally crippled its surface transportation for weeks. (Explanation: It took approximately one week for 20 to 32 inches of snow to melt away, followed by two weeks to three months of pothole repairs, particularly on the critical Potomac River bridge crossings.) Winter appears to be over. I can tell from observing my kids—spring soccer, summer camp, and bicycles now dominate their contributions to dinner-table conversation. Stay well, classmates, and WRITE!—**Steve Schlosser**, Secretary, 11129 Deborah Dr., Potomac, MD 20854

65

Well, there are not quite as many letters as last month, but this still seems to make two respectable columns in a row. Is that a record?

Carolyn and **John Golden** and their four children have moved from West Newton to Brookline, Mass. John says that the house is similar in architecture and style to the SAE house at M.I.T. Carol is having a great time restoring and decorating. John continues as director of Information Services at Honeywell Electro-Optics Division in Wilmington. . . . **Mohammad Makhdumi** is involved in managing and expanding the family business. He is currently planning the establishment of a CMC plant to serve the Middle East market. . . . **Dennis Bekeny** is secretary-treasurer of the New Haven Pediatric Society. He says that a continuing passion is white-water rafting and wilderness camping, and reports that the Grand Canyon and the Allagash are beckoning to him. . . . From **Harry** and **Barbara Vickers**: Harry is consulting on his own and that Barbara is at home with Bill, 7, Brian, 4, and Cassie, 1.

Janet and **David Kuperstein** sent a note that they were expecting their fourth child. . . . **John Butler** reports that he is moving back to California and will see us all at the Olympics (I am pretty sure that refers to 1984.). . . **Joel Westerman** married (late last year) Alison Byrne. Congratulations and best wishes.

Deborah and **David Lerner** are still living in Phoenix. Deborah is at home with Joshua, 6, and Ben, 1, and David still works for Honeywell. They would be happy to hear from old friends. David hoped to be in Boston in April (1983, I think) assuming he qualified for the marathon. He says that they make it easier after you get old—but not that easier. . . . **Greg Schaffer** sent a long Christmas letter whose highlight was that Greg had started competing in triathlons. These are a combination of a 1-2 mile swimming race, a bicycle race of 50 miles or more, and a marathon! Fastest finisher wins. Greg finished the Sierra-Nevada Triathlon about 220 out of 400, and competed in the U.S. Championship Triathlon. He is now into building his skills and endurance for more of the same. . . . **Bill Roeseler** is currently with the Boeing wind turbine program, and published a paper at the NASA/DOD conference on fibrous composites in January. . . . **Charles (Chico) Gholz** has joined Oblon, Fisher, Spivak, McClelland, and Maier specializing in patent and trademark law. . . . **Pat Winston**, a professor of computer science at M.I.T., has been elected to the board of directors of Artificial Intelligence Corp. of Waltham.

Richard Ayers has been named group vice-president, hand tools, of Stanley Works in New Britain, Conn. Richard had been president and general manager of Mac Tools, a Stanley division in Ohio. . . . **Kenneth Kruckemeyer** has been named one of the four associate commissioners of the Massachusetts Department of Public Works. . . . **Amadeo Odoni** has been named chairman of the standing faculty committee for the masters program at M.I.T.

I am now off to California for the annual IEEE symposium on security and privacy. It promises to be a nice break from New England, provided California doesn't wash away. Anne went with me last year, but it doesn't look like she can get away from Sloan this time. Keep the cards and letters coming, folks.—**Steve Lipner**, Secretary, 6 Midland Rd., Wellesley, MA 02181

66

Our classmates continue to exhibit a great deal of interest in physical fitness. **Harry Moser** has been running in 5- and 10-kilometer races and has competed in two triathlons. Possibly we should be setting up a Class of 1966 mini-marathons with Harry, **Paul Rudovsky** and others. . . . **Jim Lash** has been elected chairman of the board of Reading Industries. This is in addition to running James Lash and Co. Management Consultants. . . . **James Selbert** is president of Warren and Selbert Inc., a firm providing computer aided investment analysis in Santa Barbara, Calif. . . . **Forest Stoddard** launched Pioneer Wind Power, Inc., Amherst, Mass., an engineering consulting firm specializing in analysis and testing of wind turbines. They have developed large wind farms in California and successfully generated electricity for GP&E.

February 1982 must have been a good month for daughters. The **Matt Fichtenbaums** were blessed with daughter, Rachel Lynn, on February 27, while the **Richard Grays** were equally blessed

with the arrival of their second daughter, Jessica, on February 2. . . . We have some news from Texas. **Paul LaFata** heads up the data systems consulting practice of the Houston office of Ernst and Winney where he is a partner. Paul and his wife have children and live in Houston. . . . **Donald Haney** is a professor of quantitative management at St. Mary's University in San Antonio. He is also in the Air Force Reserve and works on automated test equipment and analysis of jet engine test data. . . . We heard from two classmates who have recently been to Russia. **Thomas Percer** visited Russia and Scandanavia on a summer cruise, while **William Marlow** gave a lecture on rarified gas dynamics in Novosibirsk in a much colder section of the Soviet Union. The Marlows are also pleased to announce the arrival of their first child, a daughter, Synnove Laurine, in June 1982. He is starting his ninth year at the Brookhaven Lab.

Back in Boston, **Quentin Klein** is completing his sixth year at M.I.T.'s Lincoln Labs where he is a software engineer and a staff mathematician. He reports he is still single and a true bicycle enthusiast who does his own repair and has built his own wheels. . . . Also in Boston, **Pete Konde** was a featured speaker at the Instrumentation and Measurement Chapter of IEEE in December 1982. Pete is an engineering manager at Teradyne. . . . Hope you all have a great summer. As you read this, I will be relaxing in Myrtle Beach, S.C.—**Joseph Shaffery**, Secretary, 34 Hastings Dr., Ft. Salonga, NY 11768

67

Carol and **George Starkschall** had a good excuse for missing our 15th Reunion: on June 10, 1982, they became the proud parents of their first child, Jessica Michelle. George has been working as a medical physicist at the University of Kansas Medical Center, Department of Radiation Therapy, since 1980. In addition to his teaching, research, and clinical responsibilities, he is serving a term as president of the Missouri Valley Chapter of the American Association of Physicists in Medicine. In his spare time George has been directing the choir at Temple Beth El in Overland Park, Kans. . . . **Frederick Orthlieb** is now associate professor of engineering at Swarthmore College. He was on sabbatical this spring, doing dynamic modeling of mechanisms and lab applications of microprocessors as well as starting a small robotics lab.

Gerald Tomanek launched a new venture in late 1982, Cohesive Network Corp., which develops intelligent network switching modes for metropolitan area networks. Gerald is vice-president of marketing. . . . **David Ofsevit** has left Mitre Corp. and is now with Digital Equipment Corp. in Nashua, N.H. He and his wife are still happily living in Watertown. . . . **Donald Davis** returned to his position as associate professor of mathematics at Lehigh University last month after spending a sabbatical year at Warwick, England, and the Institute for Advanced Study in Princeton. . . . **Andrew Mera** proudly announces the birth of his first child, Thomas Oliver, on December 2, 1982. . . . **Lin Olsen** writes that she and her husband Rich visited Don and **Cheryl Klitzke Dawson** last Thanksgiving. Cheryl teaches the flute and is principal flutist in the New York Symphony. Lin and Rich have two daughters, Kiri (8) and Bess (3).

I had a pleasant visit with **Kevin Kinsella**, one of three principals in Avalon Ventures, a recently formed venture capital limited partnership in La Jolla, Calif., that specializes in high technology investments. Having been successful in starting two companies on a "hobby" basis, Kevin decided to pursue venture capital activities full time. The two companies he helped form are Spectragraphics, a San Diego company specializing in display graphics, and Landmark Graphics Corp., a Houston firm that has developed proprietary software used to interpret seismic data. Kevin and I reminisced about the good old days at M.I.T., and my only regret was that our visit was too short.—**Jim Swanson**, Secretary, 878 Hoffman Terrace, Los Altos, CA 94022

68

Rather slim pickin's this month. I hope this is because everyone is planning to report in person at the reunion (which will have taken place by the time you read this). Congratulations to **Luat Nguyen**, an aerospace technologist in the Low-Speed Aerodynamics Division at NASA's Langley Research Center in Hampton, Va., who recently received the Lawrence Sperry Award for 1983 from the American Institute of Aeronautics and Astronautics. The award is presented annually "for a notable contribution made by a young person to the advancement of aeronautics or astronautics." Luat's certificate of citation reads: "for the development of control system concepts that have become widely accepted and used in current generation fighter aircraft for improving maneuverability and departure/spin resistance." A member of the Langley staff since 1970, Luat leads a group of seven engineers conducting research on the high angle-of-attack flight dynamics of military and general aviation aircraft. The author or co-author of 29 technical publications, Luat has also received a number of awards from Langley.

For one of the longest notes we have ever received through M.I.T.'s pledge system, we thank **Richard Challen**. He writes, "After ten years with General Electric's Mobile Radio Division in Lynchburg, Va., I have moved to Atlanta, Ga., to become director of R&D for Chromatics, a color graphics terminal company. Deanie and our three children—Richie (10), Betsy (7), and Jonathan (4)—are enjoying the mild weather and getting accustomed to the Atlanta suburbs. Competition in the color graphics area is high with 50-plus companies announcing new products. However, we feel that Chromatics will make quite a splash with a new low-cost terminal announced in March. Atlanta seems to be the perfect area for tennis freaks, and I have developed a healthy interest in it and jogging."

Gerald Schwarz, who has been at Brandeis University since 1974, has recently been promoted to full professor of mathematics there. Gerald specializes in the areas of transformation groups and global analysis. "Combining methods of transformation groups and differential analysis with algebraic geometry and invariant theory, he has forged powerful tools to attack a wide range of problems in his field of mathematics. His article, "Lifting Smooth Homotopies of Orbit Spaces," published in the journal of the Institut des Hautes Etudes Scientifiques in France in 1980, received international recognition and a subsequent invitation from the Institut to spend the 1981-82 academic year in residence there.

A few briefer items to report. **Carson Strong** announces that his wife Peggy gave birth to their first child, daughter Ardis Elizabeth, on January 4. She weighed 8 pounds, 4 ounzes. . . . **James Hsia** has been appointed vice-president of engineering at Laser Science, Inc. in Cambridge, Mass. . . . **John Dehne** is associate director of research at Honeywell Systems and Research Center, Minneapolis, Minn.

Paul Gluck writes that he continues to enjoy sunny south Florida weather as well as private practice in obstetrics and gynocology. He also teaches on the voluntary faculty at the University of Miami School of Medicine and continues an interest in allergy and pregnancy, doing clinical studies in conjunction with his wife, Joan. They have been invited to present their work at a future meeting of the American Academy of Allergy. Paul and Joan recently returned from a trip to Los Angeles where they stayed with **Randy Walsh**, who is doing research with lasers for North American Rockwell and will soon be expecting his first child. . . . One who gave up the sunny South is **Bruce Don**, who writes, "After enjoying the warmth of Atlanta and finishing up the activities as deputy chief of the Toxic Shock Syndrome Task Force at the Centers for Disease Control, I'm venturing forth to the cold and snow of Chicago." He'll be spending a year there as the 1983 Morris Fishbein Fellow in Medical Journalism at the American Medical Association.

Our own news is that we recently spent some time in Japan and Hawaii, part business, part pleasure.—**Gail** and **Mike Marcus**, 8026 Cypress Grove Ln., Cabin John, MD 20818

70

A matter of interest to all members of the class of '70 was forwarded to me by the business manager of the *Technique*, who indicated they have several copies of *Technique* '70 which they are willing to sell for $12.50 including postage. If you would like to order one, please contact the business manager at P.O. Box 5, M.I.T. Branch.

Jim Bricker is working in Littleton as president of Telequip Corp. which produces electric coin dispensers. . . . **Steven Girshick** continues to work towards a Ph.D. in mechanical engineering at Stanford University. . . . **Julie Sussman** has edited puzzles for *Harvard Magazine* for the past seven years, and has recently edited a puzzle book *Harvard Crostics* which is available through Simon and Schuster. . . . **Steven Umans** is principal research engineer in M.I.T.'s electric power systems engineering laboratory. . . . **Carl Yankowski** is still living in Stamford and is working now for General Electric as general manager of marketing in the small appliance division. . . . **Tony Rufolo** has moved to Portland, Ore., with his wife and children and is teaching in a graduate program in urban studies and planning at Portland State University. He previously had spent six years with the Federal Reserve Bank of Philadelphia, in addition to co-editing a book, *The Economics of Municipal Labor Markets*.

Michael Safonov is associate professor of electrical engineering at University of Southern California. . . . **John Carroll** is associate professor of psychology at Loyola University of Chicago. He and his wife have two children and recently spent several weeks in Europe. . . . **David Koh** is now director of Cardiology Services at the Beverly Hospital. After Harvard Medical School, he completed his internal medicine training at Beth Israel Hospital and a cardiology fellowship at the University of Washington. He and his wife live in Marblehead with their two children. . . . **James Fong** is a project cost engineer with Bechtel Corp., where he has been for the last nine years. . . . **Charles Lieberman** is the money market economist at Morgan-Stanley. At the time of this writing they were expecting their third son and live in northern New Jersey, which is delightful, yet close enough to New York to benefit from the urban excitement.

Wesley Moore complains that nobody he knows ever sends in news to your class secretary. Other than that, he indicated that his 2-year-old has taken over the house and has filled it with dolls and teddy bears. . . . **Jon Fricker** is on the civil engineering faculty at Purdue University, and his wife is finishing her Ph.D. in textile science there. Most recently he has competed in his first swim-bike-run triathlon. . . . **David Dobkin** is happily settled in Princeton as a professor of electrical engineering and computer science. He enjoys the small-town living, the college teaching, and the delights of collecting his favorite collectables. . . . **Anthony Picardi** is heading up his new company, Management Technologies, which offers an economic service. He recently returned with his wife from Guadaloupe the day before the 12-inch snow in Boston.

Christopher Rose has finished his medical degree work from Harvard Medical School and will be at the Joint Center for Radiation Therapy at St. Joseph Medical Center in Burbank, Calif. . . . **Michael Kearns** has experienced a rich year of

personal fulfillment by continuing his teaching and his writing. . . . **David Silverman** has been recently designated as an associate fellow in Monsanto's corporate program which recognizes his continuing contributions to the company. He is in the corporate engineering department and has been with them since 1975. His specialty involves materials consulting and tools for corrosion prediction. . . . **Gregory A. Jackson** recently took part in a landmark series of cooperative meetings of Boston's government, industry, and community leaders. He was the co-author of *Future Boston, Patterns and Perspectives* involving economic, demographic, and social changes for the remaining 20 years of this century. . . . The fixed income and research departments of Massachusetts Financial Service Co. has announced the promotion of **Robert A. Dennis** to the position of vice-president, investments. He is a charter financial analyst and is involved in portfolio management of municipal bond trusts and tax-exempt money market trusts.—**Robert O. Vegeler**, Secretary, Dumas, Backs, Salin, and Vegeler, 2120 Ft. Wayne Natl. Bk. Bldg., Fort Wayne, IN 46802

71

Gus J. Vlahakes is back in Boston after a three-year research stint in San Francisco. He is finishing his training in cardiac surgery. . . . **David J. Sales** writes: "After receiving a Ph.D. and M.D. at the University of Chicago, I just entered the practice of gastroenterology in the northwest suburbs of Chicago. My wife Charlene and I have a 14-month-old son, Adam, who is already at home with computers." . . . **John Calcagni** writes: "My wife Meg and I are doing well in Cary, N.C. I am still with EPA working in air pollution control. We have a one-year-old daughter, Carolyn, and a second child due in August."—**Hal Moorman**, Secretary, P.O. Box 1808, Brenham, TX 77833

72

William Greig writes that he has recently joined in forming Pilgrim, Baxter, Hoyt, and Grieg, a Philadelphia based firm providing investment management services to major pension funds. He and his wife, Margot, had a second daughter, Laura, in September. . . . **Chris Herot** is director of man-machine interfaces at Computer Corp. of America in Cambridge. . . . **Paul Levy** was renamed by Governor Dukakis to the Massachusetts Department of Public Utilities Board of Commissioners. . . . **Bruce Weinberg** is associate publisher of *Laser Focus Magazine* in Littleton, Mass.

Donald Hewitt reports that he left the Computer Sciences Corp. in February to join Storage Technology Corp., where he will serve as manager, planning and marketing support for a new System Integration Division to open in Bethesda, Md. . . . **David Stuart** got his M.D. at Stanford in 1978, and "ABIM certified 1981, FRCP(C) 1982." (I hope those initials are meaningful to all you medical folks!) He married Dr. T. Gail Mah in April and is currently with the Cancer Control Agency of B.C.

Michael McClure writes that he is "leaving for France in August for language study and will arrive in Zaire in June 1984 working in theological education by extension." . . . Finally I have a laconic report from **Paul Mitchell** that he is "still working for a living." Such, alas, is the human condition.—**Dick Fletcher**, Secretary, 135 West St., Braintree, MA 02184

73

We find poetry in our mail today. **Alan Lehotsky** writes that, after eight years at DEC, he moved to Apollo Computer Co., where, quoth he, are a large number of brass rats. At his going-away lunch, he spake the following poem: *A languages wizard named Al/Found BLISS working at Digital/Though he coded and taught/And defends the d----d dot/At Apollo he's using PAS-CAL!* I use COBOL now, and the poem I wrote on my going-away never made it into Honeywell's clutches. It's available for Alan if he'll send his address.

Douglas Moran is a professor in the computer science department at Oregon State. . . . **Stuart Goldman** recently joined the staff of the Childrens' Hospital Medical Center and the psychiatric faculty at Harvard. . . . **David Porush** teaches literature and communications at Rensselaer, and has just completed a book about the image of the machine and cybernetics in contemporary fiction.

And a last aside to **Debra Judelson**—please reread the April 1983 column, putting "I.T.T." in instead of "M.I.T." There was a typo in the final production. Like obfuscation in technical writing, the piece made perfect sense with the error, folks.

And after having been sorely taxed by the season of IRS, I think I'll step into my den and withhold a few brews to relax. Bye for now.—**Robert M.O. Sutton, Sr.**, Secretary, 819 Buckingham Ct., Warrenton, VA 22186

74

Hold onto your noses kids, here comes another "trivial" column. But before we get started, remember, only one year to 10th Reunion. This should give those of you planning on walking to Cambridge plenty of time.

There are 580 hairs per square inch on the average man's face. . . . **Robert Curley** writes that he received his Ph.D. in computer science from UCLA last June and he now works for Hughes Aircraft in El Segundo, Calif. . . . More pedestrians are killed while crossing with the light than against it. . . . I had a nice conversation with **Jean Mozolic** during the March Alumni Fund telethon. She sells (excuse me, is a sales engineer) metals coatings for Union Carbide, covering most of New England. She married **Dennis Huber** in 1975, and he is supervisor of the Nuclear Engineering Department of Combustion Engineering. They both have a number of fun-and (hopefully)-profit projects going on the side, including a venture doing aircraft interior decorating. Got a plain plane?

M.I.T. was recently voted the most expensive university in the country in two separate studies. . . . **Neal Dowling** is working for Puritan Bennett Pulmonary Products Co. near Boston. He wants to assure all his friends that yes indeed he did actually graduate, receiving his M.S.E.E. in 1979. . . . A giraffe's tongue is so long they use it to clean their ears. . . . **Steve Fantone** married Elizabeth Wayne in September 1980. They have a 10-month-old boy, Stephen Joseph. Steve's a principal engineer in optical engineering for Polaroid. . . . **William Schwab** married Patricia Masucci in October 1982. She's a flight attendant for Transamerica Airlines. He owns his own maintenance company and finds it very successful. . . . Oklahoma once passed a law making it illegal to catch a whale in that state. . . . **Dave Sussman** is still single and loves it. He's still writing networking software for Burroughs on the West Coast, and wants to send a big "Hi!" to **Ed (Mad Dog) Ringel**. . . . **Clifford Podewell** and **Mary Budarz** are the proud parents of 2-year-old Alex and 5-month-old Stephanie. They are both doctors of internal medicine somewhere, its just that I forgot to write it down when I spoke with them. Ever have one of those days?

While digging out receipts and cancelled checks for this year's income tax, your ever-faithful scribe came across a note from **Stanley Young**, lost in the drawer for who knows how long. Sorry Stanley. Here's his note: "I long ago received my Ph.D. in chemistry. Spent two years in Ithaca on a postdoc at Cornell. Am currently doing organic chemistry for Unigene Laboratories, a business in genetic engineering started by **Warren Levy**, a fellow Jack Floreyite.' I have a new son as of November 1981, Matthew. Wife Jasmine Lin is doing fine."

The greater Los Angeles area is 800 square miles larger than Rhode Island and Delaware combined. . . . **Arvind Khilnani** writes to say he's on the Stanford faculty in engineering economic systems. He's enjoying research, teaching, his daughter Reshma, and the prospect of another child in the fall. "Keeping excitingly busy." . . . When you flip a penny it is more likely to come up heads than tails. . . . A note from **Larry Eisenberg** says he's recently left the world of big-time finance in the Wisconsin State Budget Office to become director of the Bureau of General Services. . . . Whiskey and soda is more swiftly intoxicating than whiskey alone. . . . **Linda Tufts** is now working for Bain Consultants in Boston, after completing her M.S. from the Sloan School. . . . **Lemuel Arnold** recently passed his pediatric board exams. He is chief of pediatrics for HealthCare Inc. "I remain politically active." . . . The ampersand ("&") means the same thing in several hundred different languages. . . . Dr. **Peter Grain** went to Stanford Medical School and is now a resident in neurological surgery at Northwestern Hospital near Chicago. . . . Three times more women attempt suicide than men. . . . **Charles Calhoun** has a new little girl, Amanda, and a new job as a management consultant with Kenneth Loventhol and Co. in New York City. . . . **George Vitek** is coming back east to Springfield, Mass. to be at the Bay State Medical Center Department of Pediatrics. "Finally have a little girl after three boys." . . . Gail and **Dan Greene** welcomed Nathaniel into the world in July of 1982. "Gail and I enjoy him tremendously. He is eating (and growing) vociferously and seems to have a boundless supply of energy."

Here's hoping your summer is a warm one and the snails don't get into your lettuce. Please write.—Co-secretaries: **Lionel Goulet**, 34 Tremlett Sq., Dorchester, MA 02124; **Jim Gokhale**, 6 Pond Lane, Arlington, MA 02174

75

Alan Lefkof left McKinsey and Co., the prestigious consulting firm, in January 1982 to join a start-up, GRID Systems Corp. GRID has developed a powerful portable computer targeted for managerial use in large companies. Alan is managing the northern California sales effort from offices in San Francisco. He says: "By the time you read this we should be well on our way to success." You may have read an article in the February 28, 1983 issue of *Business Week* on GRID Systems and the marketing challenges they are facing. Contrary to what I learned at the school of management we all know and love, managerial use of the computer is still somewhat limited; i.e. the CEO of a Fortune 500 company does not have (and does not want) a terminal on his desk on which to solve models. GRID's product, however, is very impressive from a technical standpoint and may be, in my opinion, just what is needed to get reluctant managers involved with computers.

After four years at Stanford Medical School **Russell Phillips** returned to Boston where he is finishing a residency in internal medicine at the Beth Israel hospital. Next year he will begin a Kaiser fellowship at Harvard Medical School. "Best of all, last summer I married a special woman named Elise Tofias. **Joel Weissman**, **Wendy Landman**, **Steve Simoni**, and **Ronald Bick** were in attendance at the wedding." . . . **Michael Kozinetz** is currently working in Edmonton, Alberta as a job engineer for Canadian Badger Co. Ltd. "The winter of 81-82 was very harsh and long and it doesn't look too good for this year either. It *is* a beautiful area, and the Rockies are only a few hours away. I hope I will be doing some skiing there this season." . . . **Diana McKnight** and her husband Larry Esposito, '73, rave about their 15-month-old daughter Rhea: "We have found parenthood to be a great experience, and after all those nights doing problem sets till 4 a.m. Friday morning, getting up to give Rhea a bottle at 4 a.m. is easy. I am still working

for the U.S. Geological Survey, doing research on environmental chemistry." . . . According to **Seth Stein**: "Carol Geller (Caltech '78) and I were married on Thanksgiving Day in New York, becoming another two-geophysicist family (a growing trend). We've bought a house about one and a half miles from the Northwestern University campus where we will both be working after Carol finishes her thesis at Columbia University. Owning a house is fun—you get to cope with things like flooded basements and busted water heaters."—**Alex Castaldo**, Secretary, 929 Mass. Ave. (12D), Cambridge, MA 02139

76

Your secretary must sadly report the death of **James Fifield**. He passed away in March 1981, but the news has just reached me. Our sympathies go to his family.

The mails have given us a fair share of news. **Robert Shults** writes: "My wife Kathy and I bought a home and have settled in Montclair, N.J. Fixing up the 'ole Victorian house has brought us much pleasure. My current job is construction on a much larger scale—contract administrator for Tishman Realty, current project a 44-story office building in Manhattan." . . . **James Ryan** succinctly states, "My second son, David Wade Ryan, was born January 22, 1982."

Tom Downey is "currently at Ztel, Inc. in Andover, Mass. doing software for a voice/data PBX. It is a start-up venture, about two years old, located in a run-down industrial complex." . . . **Steve Shepherd** is "alive and well in sunny Florida. Hello Connor 5!" . . . **James Breen** is now "senior staff engineer at Analog Devices doing diagnostic and debug monitor software for the 8086 based Macsym 150."

Peter Mongeau, who also got his Ph.D. in physics from the 'Tute in 1982, was the speaker at the February meeting of the Instrumentation and Magnetics Group. He is currently the leader of the Electromagnetic-Acceleration Group at the M.I.T. Francis Bitter National Magnet Lab. He is apparently doing remarkable work in the area of electro-magnetic launching, i.e. using pulsed electromagnetics to propel objects ranging from pellets for nuclear fusion to rockets. Your secretary notes that 20 years ago this area might have only been a topic of science fiction. Now, it looks as though we are on the edge of a revolution in the field.

Steven Lubar writes, "In April 1982 I married Lisa Thoerle (University of Chicago, '76, and daughter of John Thoerle, '42). This past summer, *The Philosophy of Manufactures*, a book I co-edited, was published by the M.I.T. Press. And in November, we move to Washington, D.C., where I have an appointment at the National Museum of American History at the Smithsonian Institution, doing the behind-the-scenes work on a new exhibit on the American Industrial Revolution."

Your secretary had the pleasure of bumping into **Alan Swide** in the lobby of 1 World Trade Center recently. Alan is totally recovered from the broken leg he had when I saw him last, at our reunion. He is still at Bear, Stearn, and Co. on 55 Water St. However, he is now a trader on the GNMA desk. This is one of Wall Street's more nerve-wracking professions, and, I must say, Al looks great, especially considering the pressure.

As for your secretary, his trading world is moving briskly, too. Among the big movers: the precious metals, forex, stock indices, bonds, bellies, and that ubiquitous American favorite, soybeans. For the moment I am resting from traveling, and as I write these notes on a chilly, rainy afternoon, I am sipping an oak-aged rum, neat. However, I must confess, the pressure of trading has started to affect me a bit—a few more grey hairs since our reunion. Fortunately, that is all. I can still safely say that I remain a "commodities junkie." Please keep the letters coming.—**Arthur J. Carp**, Secretary, 15 Jones St., Apt. 3D, New York, NY 10014, (212) 741-3023

77

Well, after months of "short rations," my mailbox overflows with news. **Stephen C. Nolet** is working on a master's degree in aeronautics and astronautics and hopes to finish in December. Stephen was married in June 1982, and "really enjoys the new lifestyle." . . . **Dan M. Rice** is now a lawyer, working in the area of commercial litigation, at Tunstead, Schechter, and Torre in New York. . . . **Mark Mintun** and his wife Susan have been living in St. Louis for four years. Mark has graduated from Washington University medical school, finished an internship which he didn't enjoy too much, and is now doing research which he enjoys very much with the new PET scanner. Mark asks, "Are there any other former New House V residents in the Midwest?"

Arthur D. Perez received his Ph.D. in chemistry from the University of Michigan and is now working the pharmaceutical division of Ciba-Geigy. Arthur is looking forward to the wedding of **Barbara Thornton** and **Rich Smiley**, who will be his neighbors in Summit, N.J., while Rich completes his internship. . . . **Marc S. Levin**, and his wife, **Deborah Rubin**, are residents in internal medicine at Barnes Hospital in St. Louis, Mo. . . . **Andre K.Y. Au** is now director of project management at Signature Interests. . . . **Margaret L. Brandeau** is now working on her Ph.D. in engineering-economic systems at Stanford, and expects to complete her studies within a year. Her brother Greg is a student ('84) at M.I.T.

William R. Cohen has started a new venture, Enertex, Inc. Enertex acts as a manufacturer's representative for solar and energy conserving products in the northeast. . . . **Reeson J.I. Winter** is now a self-employed computer consultant, chairman of N.H. Space P.A.C., and will be married in September 1983. William also states, "I've found a marvelously simple, proven method for making $$$ and showing others the same system!"—but he did not divulge it to your secretary.

Mark A. Green married Marian C. Lysik in July 1982, and is currently working in audio productions, voice and data communications, and database software. Mark's wife works for a specialty advertising firm in San Francisco. . . . **Michael A. Selig** is working in energy conservation at a Boston consulting firm, and will give a talk on photovoltaics on March 16 at a meeting of the Urban Solar Energy Association. Michael will also be getting married in the fall. . . . **John J. Nugent, Jr.** completed his Ph.D. in physics at Caltech last October, and is now a member of the technical staff at TRW in Redondo Beach, Calif.

Barbara L. Smith will receive her M.D. and Ph.D. this June from the Harvard-M.I.T. Division of Health Sciences and Technology. Barbara will start a general surgical residence at the Brigham and Women's Hospital in Boston, as will her husband, Jay (William) Ericson, '79. . . . **Jeffrey Swalcheck** is currently a doctor with the U.S. Navy aboard a submarine tender, and is about to enter an internal medicine residency at the naval hospital in San Diego for the next two years. Jeff also mentioned that **Steve Keith** is currently aboard the *U.S.S. Fox* out of San Diego, and is headed for an instructor billet at Idaho Falls, Idaho, and that **Dave Bieberle** is now working in Nashua, N.H. for a computer software firm.

That's all for this month—thanks so much for writing. If any of you happen to get out west this summer for a vacation, or for the Sports Festival here in Colorado Springs, give me a call.—**Barbara Wilson Crane**, Secretary, 6431 Galway Dr., Colorado Springs, CO 80907, (313) 599-0839

78

Once again, it's time to settle into your favorite comfortable chair, lean back and read your own (almost) monthly gossip column. Try not to spill your breakfast cereal on it this time.

Reports from academia. Did you know that we have at least three professors in our class? There's **Paul Lagace**, who hasn't left M.I.T. in nine years, now a professor in the Aeronautics and Astronautics department. . . . **Leslie Jane Federer** and **Bob Indik** just finished their graduate work at Princeton. Leslie is an assistant professor at my second alma mater, the University of Michigan. Bob is an assistant professor of math at Brandeis; he notes that he is living in North Cambridge and that he got married this June to Julia Heisler (whom he met at Princeton).

A very nice boring postcard comes from **John Blaisdell**, who is working on a postdoc at Johns Hopkins. (The card is of Lewisburg, Pa., "an exciting small town where we stopped to buy Scotch Tape." Thanks, John. . . . **Jean Gregory** writes that she "finally finished [her] Ph.D. in materials science at Stanford. . . . Now I'm off to Germany for a two-year postdoc in Hamburg."

Jack Lissauer writes from Palo Alto that he got his Ph.D. in applied math from the University of California, Berkeley last December, and that he is now doing postdoctoral research on the origin of the solar system at NASA Ames Research Center. . . . **Robert Bjorge** just finished his Ph.D. in mechanical engineering at the 'Tute in January. He's now working for GE's Medium Steam Turbine Department in Lynn, Mass., and directing bridge tournaments on weekends.

David Levens is working in the emergency room of Jacobi Hospital, the busiest city hospital in the Bronx. Before that, David was a surgical intern at Montefiore/Albert Einstein in the Bronx. . . . **Ira Pollack** is a neurology resident at New York University in New York City. In order to ease up on his own nerves, he does a lot of skiing and rock climbing. . . . Soon to be a practicing physician, **Barbara Ostrov** is at medical school in Buffalo, N.Y.

Next come the lawyers. Peck, Shaffer, and Williams in Cincinnati announce that they acquired the services of **Steve Lawrence**. Steve and I suffered through the University of Michigan Law School together, from whence he moved to Cleveland. . . . Soon-to-be J.D. **Carrick Davidson** is at the University of Texas Law School in Austin.

Kathy Hardis Fraeman sent another great boring postcard—this one is of Flipper "doing the famous tail walking act." Kathy was promoted to "senior staff" at her job in D.C. where she designs data bases for occupational epidemiology studies. She and her husband Marty ('73) just bought a new house in Rockville, Md. . . . **Sheila Luster** writes that she has left the active army (she's still in the reserves) and that she is working in Tuscon, Ariz., once again a civilian.

Linda Lampron called to say she (like Sheila) just left the armed services. She loved the southern hospitality of Galveston, Tex., where she spent two years in the Army Corps of Engineers, but has since returned north to work in the Boston area. . . . **Craig Stephens** is working as a consultant at Pugh-Roberts Assoc., in Cambridge, specializing in computerized decision support simulation models for corporate executives. . . . **Michael Lynch** is a research associate at M.I.T.'s Energy Labs, studying international energy markets.

Aryeh Weiss writes to clear up some confusion from previous slander sheets. Aryeh and his wife, **Ethel Sherry Gordon** are grad students at M.I.T. and are the proud parents of their young son Yaacov Yoseph. (Sorry about the confusion—DB) . . . **George Orlov**, acting assistant director of the quality confirmation program, is working as a consultant to Cincinnati Gas-Electric, attempting to resolve potential construction deficiencies at a nuclear power station. . . . **John Jaynes** is back from Misawa, Japan, teaching electrical engineering at the U.S. Naval Academy. . . . **Mike "Geese" Geselowitz** is still working on his Ph.D. in archaeology at Harvard, spending summers digging up ruins in Yugoslavia and "bumming around Europe in general."

Dennis McMullen took his master's in biology

from the University of West Florida and came north. He is now doing research in environmental science at the University of Cincinnati Medical Center, and has just celebrated the first anniversary of his marriage to wife Pam. . . . Other new marriages. **Cicely Frampton Rodal** announces her marriage to Dr. Jose Juan Antonio Rodal, '74 (December 1982 in Coronado, Calif.). . . . **Mark Pape** married Diana Kirshen, S.M. '82, last July. They both did their graduate work at the Parsons Lab at the 'Tute, after which they went to Kenya with Louis Berger, International, to develop a master water plan of the Kitui District of Kenya. They've now settled down in the Washington, D.C. area.

After two years as a player on the University of Wisconsin Rugby Club, **Roy Colby** has retired and moved on to refereeing. (I didn't know they had referees in rugby.) Roy has now been upgraded to C-2 status as a rugby ref. . . . Entrepreneur of the month award goes to **Robin H. McCaffrey**, founder and president of Needham-McCaffrey Assoc., Inc., a professional corporation offering services in development planning, community planning, urban design, and architecture. Best of luck, Robin.

Sharon and **Doug King** wrote about life in sunny southern California. Sharon is a student at and consultant for the San Francisco State University school of science computer lab. Doug teaches part-time at San Francisco State and works for a firm that designs and builds custom automated assembly and manufacturing machines—working on processes for anything from steel rivets for jeans to disposable hospital gowns to contact lenses and computer printers. Together they have been remodeling the interior of their house, playing tennis, and skiing.

Kathy Kielmeyer is working as a member of the technical staff of the Betac Corp. in Arlington, Va. . . . **Bill Lull** writes: "Still working in New York City. . . . and two years is about enough. Thinking about getting out of building engineering and into computers. Does anybody need help with microcomputers in San Francisco or Boston?" . . . **Nancy Lukitsh** and **Mary McNally** both recently got their M.B.A.s from Harvard. Mary is now living in Arlington, Mass., working for Teradyne. Nancy is in New York City working for McKinsey Consulting.

Least of all, there's me. Your devoted secretary spends his weekdays as a mild-mannered civil servant, actually working to lower taxes and health insurance premiums. My usual duties of litigation and policy advising has been supplimented by some work on legislation on Beacon Hill. On the home front, we recently started condo shopping in Cambridge only to discover that it's hardly worth it to go condo shopping in Cambridge on a mild-mannered civil servant's salary. Send me boring postcards from your summer travels—no town too small, no tourist trap too kitsch. Just send them with your news to—**David S. Brown**, Secretary, 50 Follen St., Apt. 104, Cambridge, MA 02138; (617) 491-5313, work (617) 727-1190

79

Hello again, classmates. Let's not beat around the bush—down to the gossip! . . . **Bob Light** read some rumors I printed about him in a previous column and decided to write and confirm them. He is getting married August 7, and has left Iowa to become the manager of the computer-aided design lab in the mechanical engineering department of—yes, you guessed it—M.I.T.! Thanks for writing, Bob. . . . **Brent Myers** married Robea El-Azhany and honeymooned in Egypt in December. Brent will have completed his M.D. from the University of Texas Medical Branch in May, and he plans to begin a residency in internal medicine. Congrats! . . . **Jeffrey Block** is still alive and well in Madison, Wis. He writes, "I attended a New Year's party in Boston and had a great time with some old Conner 3 folks: **Joe Zachary, Bill Wood, Hank D'Amato, Ed Vogel, Mike Strauss, Steve Utkus, Don Bender,** Brian Foody, '80, Peter George, '80, and Bruce Leshay, '80. I'm still an R.A. in the physics department. Our group is building an X-ray astronomy experiment to look for X-rays coming from hot plasmas distributed within our galaxy. It keeps me out of trouble!"

Gregory Allegretti writes, "I was recently elected to the United States Congress." (Mine is not to question, just report!) . . . **Ed Tarney**'s latest missive absolutely defies paraphrasing: "I have recently switched professional areas, and am now getting into urban recreational architecture usage and recycling of grocery containers as liquid meal holders. Some people call it lying around on park benches, watching the pidgeons, and drinking out of a paper sack, but it frees me of all the pressures of modern corporate society (except sometimes my tie gets wrinkled when I get mugged). That reminds me—anyone heard from **Craig Albert** lately?" . . . **Ifiyenia Kecocioglu** is involved in the study of gas-solid fluidization phenomena and application to reactor designs for fossil fuel and fluidized-bed processes. (It's times like these that I wish I had studied engineering!) She doesn't say for whom she works or where she studies, but she did divulge that she lives in Pittsburgh.

Beth Broome is graduating this spring with an M.D. degree from the University of Pennsylvania, and at press time was waiting to hear about the match results for pathology residency programs. . . . **Caren Kelman** spent three years in product marketing with Hewlett-Packard, and since 1982 has been ISV program manager with Digital Research. . . . **Robert Simms** is an automation systems analyst/engineer for IBM in Lexington, Ky. . . . **Peter DeForest** graduated with an S.M. from the Sloan School in 1980, and is working in San Francisco as group product manager in the World Banking Division of Bank of America. Writes Peter, "I enjoy seeing former classmates and would like to solicit entrepreneurial venture ideas." . . . **Sow T. Chu** got his M.S. in electrical engineering from the 'Tute in 1981 and went to work as a design engineer for National Semiconductor Corp. Recently he joined the General Electric Research and Development Center in Schenectady, N.Y., as an electrical engineer.

Our man in the navy, **Norman Gulvens, Jr.**, is still stationed on *U.S.S. Long Beach*. Norman put on lieutenant's bars last August. Congrats! . . . **Peter DeForest** has been a product manager at Bank of America, World Banking Division, since June 1981, and was recently promoted to group product manager. Peter got his S.M. from Sloan along with his S.B., and is seeking other Sloan alums interested in developing outside entrepreneurial activity. . . . **Roger Arndt** is still a director at Saint Anthony Falls Hydraulic Laboratory at the University of Minnesota. Roger says, "Elected fellow, ASME, Associate fellow, AIAA. My own research areas currently funded are cavitation (NSF), jet noise (AFOSR), hydroacoustics (ONR) and hydropower (legislative commission for Minn. resources, EPRI). Laboratory as a whole involved in a broad spectrum of applied and basic research in fluid mechanics and water resources." . . . **Cathy Miner** is still living in Eugene, Ore., and working as a project engineer and relief maintenance foreman in the wood products division of Weyerhaeuser, in Springfield, Oregon.

Troy Crites dropped a line from Los Angeles, where he is still working for the Aerospace Corp. He writes, "Involved in planning and assessment of 'Man in Space' for the military. This includes everything from astronauts getting sick on the shuttle to the need for a military space station. Exciting stuff. I got married to Kathryn Cornelius, Wellesley, '80, on January 3, 1983. (If you're going to get taxed for being married, you might as well be married all year!)" . . . Some news about **Bob Hull**. Although we were both very active in M.I.T. theater (I with the Musical Theatre Guild and Dramashop, he with the Shakespeare Ensemble), we had never appeared together. Well, by the time you read this, that oversight will have been corrected. In May, we will both appear in a three-week run of the musical *Fiorello!* at St. Bart's Playhouse (that's off-off-Broadway!). Bob has just returned from a two-month tour of *Cyrano de Bergerac* with the National Theatre of the Performing Arts. Performing the roles of Christian and Valvert in both French and English (!), Bob played in Winston-Salem, Orlando, Tampa, Dallas, Ft. Worth, New Orleans, Chicago, and Harrisburg, among others. He is now an authority on the Day's Inn chain throughout the country! Now that he is back in the Big Apple, Bob is hitting the boards once again. . . . As for moi, I'm wrapping up two weeks on jury duty. So far I have had no luck in getting selected for a jury (although I've been interviewed three times), but at least I'm getting my 30 cents worth out of the *New York Times* every day. I'm even getting a chance to do the puzzle. If you're stuck for an Austrian river, drop me a line.—**Sharon Lowenheim**, Secretary, 131 E. 83 St., Apt. 2G, New York, NY 10028

80

Spring is in the air and a young man's thoughts turn toward intramural softball . . . I say **Frank Wojtowicz** warming up his arm on the banks of the sunny Charles the other day. And a young woman's thoughts turn toward . . . crew, of course. **Kate Mulroney** and I are planning to race **Tabetha Frey McCartney** and her crew at Wharton. Tabetha, by the way, was married in March in a lovely ceremony to Lee McCartney.

Classmates who are pursuing yet another degree. **Juan Zambrano** is at the University of Chicago Business School. . . . **Arthur Low** is a graduate student in chemistry at SUNY Stony Brook out on Long Island. . . . **Geoffrey Cooper** is a graduate student at M.I.T., expecting his S.M. in June 1983. . . . **Tim Morganthaler**, completing his third year at Dartmouth Medical School, is thoroughly enjoying himself and can't decide what area to specialize in. Last I heard, he was headed out to San Diego to do his surgical rotation. . . . **Ralph Vinciguerra** writes, "I finished my M.S.E.E. in 1982 at M.I.T. I am now working on my Ph.D. here, and am the first director of the new Thirsty Ear graduate student pub in Ashdown House." Sounds great Ralph, just hope you keep the beer cold.

Speaking of enterprising individuals, **Leslie Newman** writes, "In September 1981, Michael Caruso, '75, and I started our own company to provide decision support system consulting services to large corporations. Our first year was profitable and we are planning to release our first software product later this year." . . . On the downside of American industry, **Chris Moss** reports, "My wife Mira (Wellesley, '81) and I are living in Pittsburgh. I sell steel, if you want to consider trying to sell steel as actually selling it! I'm getting my M.B.A. at Pitt part time. Is there anyone around who doesn't have their M.B.A.? **Larry Cater**, where are you?" . . . **Frank Geisel** sends to us via dogsled, "I am preparing for my third expedition examining Arctic winter ice conditions in the Bering, Chukchi, and Beaufort seas. This work is in preparation for increased marine activities in the area, and is sponsored by the Marine Administration, U.S. Coast Guard, and private industry."

Classmates in the press. New England news clips report the following. From the *Westfield Evening News*, Westfield, Mass., second lieutenant **Robert Lucadello II** has completed a field artillery officer basic course at the U.S. Army Field Artillery School in Fort Sill, Okla. During this course, he gained proficiency in artillery techniques and was introduced to new weapons doctrine. Sure beats studying projectile motion for 8.01. . . . And from the *Cape Cod Times*, Hyannis, Mass., **Peter Schecter**, now a second year environmental law student at Boston College, has been working on an offshore pipeline study for the Georges Bank area, under the auspices of the Mass. Coastal Zone Management Office. In the

event that there are substantial oil reserves off the Georges Bank, a pipeline is one approach under consideration for the distribution of the raw material. Peter's study has identified and described the biological, physical, and geological features of possible underwater pipeline routes; it has highlighted a pipeline's potential damage to natural resources and conflicts with established industries such as shipping and fishing.

That's all the news for now. As for me, as we go to press I'm in the midst of the infamous Harvard Business School management simulation game, a computer-based one-year simulation of a competitive environment in the shire industry. (Don't ask—it's worse than a widget.) The strategy: keep volume high, debt low, and plenty of cold beer on hand. Hope you all have a good summer.—**Debra A. Utko**, Assistant Secretary, 13A Soldiers Field Rd., Boston, MA 02163

81

My mailbox runneth over this month. I guess it's either feast or famine. **Christopher Eliot** writes: "I'm working for a small computer company, Cyb Systems, as 'marketing technical support.' This means I'm the technical person in the marketing/sales corner of the room and get to talk to lots of confused and/or irate customers. Austin is lovely, I plan on staying here indefinitely—I just bought a house. The weather is great, the lakes clean, and the women stunning. What more could you want?" . . . As a matter of fact, **Lisa Parechanian**, of McCormick 6th West fame, seems to be doing quite well for herself. She says life in California (beefcake city?) is wonderful, too. ("That is, except for the mudslides.") Lisa writes: "The land is incredibly beautiful and I've found the people very friendly—besides, half of M.I.T. is working out here! I'm working towards my Ph.D. in electronic materials here at UCLA at Berkeley (and will be working for the HP Labs in Palo Alto this summer)." Her doctoral thesis continues work done in her master's thesis, that is, molecular beam epitaxy of semiconductors. (Must make for fascinating cocktail conversation with those Southern Cal beefcakes—just kidding.) Lisa writes that **Evelyn Jacobson** and **I-wen Huang** are also working out in California in the materials area, but working "in the real world."

Other news from McCormick Hall via Lisa. **Merry Ferris** is busy chemically engineering at Proctor and Gamble in Ohio. . . . **Nancy Saraf** is electrically engineering at Bell Laboratories in Chicago (where **Craig Stevens** is breezing through medical school). . . . **Jenny Ford** is in Arizona where she's working in electrical engineering for Motorola, and **Laurie Christopher** (electrical engineering) has recently been in Germany working for RCA!

Roger Ishimoto is employed as a member of the technical staff at Watkins Johnson Co. in the Communications Systems Department in Gaithersburg, Md. He says he bought a townhouse and enjoys being out of school. . . . **Chun-Chee Lau** just quit McNeil Consumer Products Co. to pursue an M.B.A. at Wharton. In light of the Tylenol tragedy, Chun-Chee thinks his timing wasn't too bad. He writes, "Studies at Wharton are challenging, but it's fun to be back in school." . . . **George Dowd** has returned to Sloan after two years as a management consultant. . . . **Rob Close** writes, "Surviving grad school here in Berkeley along with many of my '81 classmates—most of whom I never met at M.I.T.!"

In the working world, **Laura-Lee Davidson** is relocating to Washington, D.C. from King of Prussia, Pa. to be a computer analyst for General Electric in Springfield, Va. . . . **Lynn Radlauer** has moved back to Boston and is working for Bain and Co. in Faneuil Hall marketplace. . . . **Paul Marcus** is now working as a project director for Hyatt Hotels building the $38 million Princeton Hyatt. . . . **David Mark** is living in D.C., working for McKinsey and Co., a management consulting firm. Dave says that everything is going well. . . . **Claudia Buser** is working at Wyeth Laboratories, Inc. in penicillin fermentation R&D. . . . **Jeffrey Menoher** writes that he is "teaching high school physics, building better mousetraps, and removing the stumbling stone." . . . **William Chambers** received his M.S. and went to work for Data Precision as a project engineer. William writes that he is adjusting to "off-campus social life with good results."

For some reason a lot of our class members seem to like to hang out at air force bases. **Bill Uhle** graduated from pilot school, USAF, (Columbus AFB, M.S.) in February. Not only did Billy get his wings, he was a distinguished graduate and received the award for academic excellence and the ATC Commander's Trophy (the highest award). Billy is to start training this summer in the F-16 at MacDill AFB in Tampa, Fla. . . . **William Shelton** graduated from the Air Force Institute of Technology in December 1981 with a master's in aeronautical engineering. He currently is an analyst at Wright-Patterson AFB, Ohio. . . . **Richard Martin** writes: "Since May 1982, I have been assigned to Edwards, AFB working as a flight test engineer for McDonnell Douglas on the second of the four existing AV-88 Harriers. Vacation time was taken in June, however, for my wedding in Florida. [Congratulations!] All is well for both my wife and I."

Speaking of married life, **Danny Kon** writes: "My wife, Holly, and I just moved to Israel six months ago, and we are building a house in Karnei Shomron. I'm working as an engineer at an R&D lab in the Tel Aviv area. Regards to everyone in our class!" . . . Finally in the short and sweet department, **Michael Rosenthal** writes that he is "staying warm in southern Cal." Sounds good, Mike.

Thomas Barta of M.I.T. Marching Band fame writes: "Some major turns have taken place in my life and the life of some of my '81 friends. Foremost, I'm very happy to announce my engagement to Dawn Jegley, '83. We plan on getting married this June, and are thinking about a Honeymoon in the Poconos before setting back to Rochester as I finish my Ph.D. in chemistry. . . . I recently got a card from **Eric Hughson**. He's still living on Long Island working for Generation Sciences in Jericho. He's still trying to find his way into business school; however, in the meantime, he fills his free time by trying to start a rock group and by doing some modeling for some local men's clothing stores. . . . I've also heard from another Third Easter, **Rob Schoenburger**. He's just now finishing up his master's in ocean engineering at M.I.T. He spent last summer traveling in Europe, and really got around from what I hear. He plans on taking a job with an overseas firm based in Singapore, where he can spend his time studying Far Eastern religions as well as tooling. . . . News from **Chris Wheeler**. He has decided to quit the service in order to start his own collection agency business in Miami, Fla. Guess it'll be fun and foreclosures in the sun for Chris!"

Thanks for playing secretary, Tom. So let's hear from the rest of you guys!—**Chuck Markham**, Secretary, 362 Commonwealth Ave., 2E, Boston, MA 02115

82

Hi again! For those who are interested, the 1983 *Technique* is available. It includes six pages of our graduation, as well as an extensive journal covering the last term of our senior year. There are also portraits of people in the Class of 1983. You may buy the book by sending $20 (includes $2 for postage) to Technique, M.I.T., Box 5, Cambridge, MA 02139.

Steve Taylor writes in to let us know that he *is* human and made a few mistakes in his last letter to the class. (**George Paoletti** says that actually, Steve is just getting in some practice for his future career as a staff writer for the *National Enquirer*.) Steve also sends his own sordid story—employment has found him. (He tried to hide, but to no avail.) He is stationed at Eglin AFB. He will be an acquisition project officer or, in other words, "he'll be buying guns." He "plans to work heavily on his tan to take care of the natural morale problems that arise from such a job." Love and kisses to you, too, Steve.

Mark Mayer writes that sister **Janice Mayer** is alive and well and working for Eastman Kodak in Rochester, N.Y. (my home town!) . . . **Crystal Barker** has been a big help to me in the telethon program. She has come in to call you many times for support for M.I.T. She is a second lieutenant stationed at Hanscom Air Force Base in Bedford, Mass. She is working in the geophysics laboratory in the cloud physics branch of the Meteorology Division. Crystal is also taking classes at the Harvard Extension School. . . . **Michelle Hunt** was living in Los Angeles working for Hughes Aircraft Co. but has since gone to work in West Palm Beach, Fla. to work for the United Technologies Research Center Optics and Applied Technology Lab as a project engineer. (Looks like Michelle likes those warmer climates!) Michelle also writes about **Eduardo Moas**, who currently works for UTRC as a structural engineer. By the time this column comes out, they should have been married. (Congratulations!) Finally, Michelle mentions that **Bill Dawson** is working at Hughes and also plans to be married soon. (Is there anyone in the class besides me that doesn't plan to be married soon? Is "old-maid-hood" in my future?)

Sue Jackson spent last summer in Cambridge "trying to earn money." She looked for a job here for two months. Alas, her only offer was from General Dynamics/Pomona Division. So, in mid-November, Sue added one to the population of the Los Angeles Basin. Sue notes it's just about ten minutes from skiing on Mt. Baldy. She says, "Yes, it is possible to find work as a technical writer!" Sue also sends news of **Maripat Carr** who is at medical school in Chapel Hill, N.C. (Maripat, please say hi to Dan Shapiro, '81, who is also at Chapel Hill.) Finally, Sue mentioned that **Sue Koppel** is a fellow General Dynamics employee at Forth Worth. Thanks for writing, Sue!

I got a great note from **Michael Post** in three colors complete with drawings! Mike says he was residing in sunny Orlando, Fla., attending the Naval Nuclear Power School. In March he migrated northwest to visit the "ubiquitous sheep and potatoes of Idaho" while finishing the second half of school. (Or is that the second half of finishing school?) In any case, he is then "off to parts unknown for a wild world cruise and four years of adventure courtesy of Uncle Sam." . . . **John Hollis** is currently working as a zookeeper at the San Antonio Zoo. He is gaining experience to help him enter veterinary school at either Tuskegee Institute or the University of Georgia. (John, there are a few animals in the class that I wish I had a zookeeper for!) . . . In a more technical vein, (they're like arteries—who says I have a lousy sense of humor?) **Robert Congdon** writes to let us know he presented a paper, "Graphic Input of Solid Models," at the conference on CAD/CAM technology at the 'Tute last March 1982. He's currently employed at Applicon, Inc. in Burlington, Mass., as a graphic systems software engineer. . . . **Karen Perizzolo**'s note is short but to the point. She's a first year student at Stanford Medical School. (I guess those med students don't have a lot of time to write.) . . . I talked to **Andrew Rallis** from a telethon at the 'Tute. We won't mention how much money he did or didn't donate, but he did let me know that he's studying to be an actuary at NCCI in New York.

Finally, yours truly (that's me) has ceased employment at M.I.T. as telethon coordinator. If you'd like to be a groupie for my rock and roll band, I am currently accepting applications. Please send $15, along with a statement of 500 words or more telling me why you'd want to be a groupie for a band that has no talent, no records, and no fame. Actually, the statement is optional. I love all your letters! Hope to hear from you soon.—**Rhonda Peck**, 38 Bigelow St., Cambridge, MA 02139

Courses

Dr. Jennie R. Patrick (born 1949), Chemical Engineer

In 1979, when she marched across the platform in Killian Court to receive her M.I.T. degree, Jennie R. Patrick was the first black woman in the U.S. to hold a doctorate in chemical engineering. Now she's honored by CIBA-GEIGY as an "exceptional black scientist" in a program designed to encourage young blacks and other minorities to prepare for scientific careers.

I

Civil Engineering

Mary Elizabeth Schumacker, '60, leaves her post as senior lecturer in civil engineering this month to seek a career that will involve more research than is possible under her present position, she says.

Harold F. Hemond, Ph.D.'77, who is associate professor in the Water Resources and Environmental Engineering Division of the department, now holds the Henry L. Doherty Professorship. Under the Doherty program, administered by the Sea Grant office, promising faculty are given special support for research on ocean science topics. Dr. Hemond's primary research interest is biogeochemistry—the study of materials cycling and transformations in ecosystems such as salt marshes, bogs, and lakes; he's also a specialist on the effects of acid rain on aquatic systems.

Thomas L. Brown, S.M.'73, is currently president of his own firm, T.L.B. Associates, Inc. This black-owned geotechnical consulting firm (headquartered in Millersville, Md.), is practicing in the Northeast—from New York to Virginia. . . . **Kevin J. Phillips,** S.M.'73, began Fanning & Phillips: Environmental Engineers in 1981, and teaches at the State University of New York at Stony Brook and Polytechnic Institute of New York. . . . **Norman S. Kram,** S.M.'73, was recently named vice-president/marketing of the Barkan Companies, Chestnut Hill, Mass.

Charles E. Carver, Jr., Sc.D.'55, Professor of Civil Engineering at the University of Massachusetts, Amherst, recently spent a sabbatical leave at the University of Edinburgh. He worked with Stephen Salter (and his research team in the mechanical engineering department), inventor of the "nodding duck" wave energy conversion device. . . **Paul Y. Thompson,** Ph.D.'68, recently returned from Saudi Arabia where he was vice-president and managing director of a large construction operation. He is currently doing research work—privately and with the United States Air Force Engineering and Services Laboratory, Panama City, Fla. . . . **Kenneth R. Maser,** Ph.D.'71, since 1979 has been manager of the Materials and Structures Division at Foster-Miller, Inc. He is currently promoting a proprietary process for isolating hazardous waste dumpsites. He, his wife (Susan Lutwak), and their one-year-old son, Gabriel, live in Arlington, Mass. . . . **John M. Ting,** Sc.D.'81, is currently a research fellow and lecturer at Caltech. . . . **Katherine O. Thompson,** S.M.'81, is currently employed in the Environmental Quality Division of Metcalf & Eddy, Inc., at the world headquarters in Boston.

Cranston R. Rogers, S.M.'51, a civil engineer with "expertise in Houston's traffic problems and over 30 years of experience in transportation engineering and development, has been appointed manager of facilities design for Houston's Regional Rail Transit System." This rapid rail system which will serve a major portion of Houston commuters is proposed to be operable by mid-1987. . . . **Max D. Sorta,** S.M.'50, employed by Fay, Spofford & Thorndike, Inc., Boston (since 1951), has been elected the firm's president. A great deal of his work has focused around the supervision of design and construction of port and industrial facilities. . . . **Thomas F. Gilbane, Jr.,** S.M.'75, vice-president—manager of the Midwest Regional Office of Gilbane Building Co., Providence, R.I., building contractors, has been elected executive vice-president of the company. Along with his managerial responsibilities, he will continue to oversee the company's Midwest Regional Office from its Cleveland office.

II

Mechanical Engineering

Professor Thomas B. Sheridan, Sc.D.'59, has received the grade of Fellow in the Institute of Electrical and Electronics Engineers (IEEE) "for contributions to engineering education and

man-machine systems."

Derek Rowell, associate professor in the department, and his wife Allison have been chosen as housemasters of the New West Campus Houses, effective in the fall. To take the assignment, Professor and Mrs. Rowell gave up their assignment as junior faculty residents in MacGregor House—"a hard decision," they said; "I hate to lose contact with the people here, Mrs. Rowell said. The Rowells succeed Professor **James H. Williams, Jr.,** '67, and Karen H. Goodall, who announced their plans to leave the house unexpectedly last fall.

Professor Steven Dubowsky, who joined the M.I.T. faculty in 1982, is now associate director of the Laboratory for Manufacturing, where he will be associated with **Professor Nam P. Suh,** '59, director. Dr. Dubowsky holds degrees in mechanical engineering and control systems from Rensselaer and Columbia, and he was a member of the faculty at the University of California in Los Angeles for ten years starting in 1971; his research is concerned with the dynamic behavior of nonlinear machines and electromechanical systems.

Ashok Boghani, Sc.D.'74, a consultant with Arthur D. Little, Inc., Cambridge, recently directed a study for the Electric Power Research Institute and the nation's electric utility companies. The study sought to determine if the switching to aluminum cars in place of the traditional steel hoppers used to carry coal from mines to power-generating stations would result in a cost savings. It was concluded that since the aluminum cars weigh less than the steel hoppers more coal could be transported and a return is "possible if regulators allow investing utilities to retain the savings from the use of aluminum cars." . . . **William B. Hoff III,** S.M.'80, reports, "I am currently a development engineer in a corporate engineering R&D group, working primarily on future electronic components at Corning Glass Works, Corning, N.Y." . . . **Thomas Murtaugh,** S.M.'66, is currently an attorney—a partner in products liability for a law firm in Long Beach, Calif. He is also an adjunct professor of thermodynamics in the Department of Mechanical Engineering at California State University, Long Beach.

Sidney A. Whitt, S.M.'34, writes, "retired as professor emeritus at the School of Environmental and Resource Energy at the State University of New York. My son Greg (Yale, Ph.D.'64), is now professor of developmental biology and a fellow at the Institute for Advanced Study, University of Illinois, and my son Ward (Cornell, '69), is a research associate at Bell Laboratories. Travel to old familiar places . . . went to my wife's 50th Smith College reunion. Am still cheering for engineering education and am on the scholarship committee as state director of the Montana Society of Engineers. Would be nice to have an M.I.T. reunion of some of the S.M. graduates class of '34—50th comes only once. Could try to stir up the ones that come to mind: Robert Darby (Course XVI, S.M.'34); **Frank Dean,** S.M.'34; **Herbert Haley,** Sc.D.'35; **Walter Galazzi** (Course III, S.M.'35); **Peter Kalustian,** S.M.'34; **Neil E. Hopkins,** S.M.'33; **Charles McFarland,** S.M.'34; **Edgar Popov** (Course I, S.M.'34); and **Charles Winters** (Course XV, '34)—if I had their addresses. If any come up to the Yellowstone Park area we'd be pleased to have them stop by—we are 80 miles north of it on a 'good road.'" . . . **Jerald J. Kwilos,** S.M.'80, is presently a member of the technical staff at Bell Laboratories, Whippany, N.J.

Joan E. Schaffner, S.M.'81, reports, "I am currently employed with Energy Management Associates, Atlanta, Ga., as senior consultant for the Client Services Department. I work closely with a number of large electric utilities in production costing, strategic planning, and maintenance scheduling issues." . . . **Alexander J. Stuart, Jr.,** S.M.'39, is currently president of the National Character Laboratory, Inc., coordinating research to confirm a new theory that there is a moral component of IQ. He is also coordinating a national program to get a new national crime plan developed and has submitted a proposed Crime Planning Act of 1983 to Congress.

John A. Clark, Sc.D.'53, writes, "I have recently been appointed director of research of Star Pak Solar Systems Corp., Novi, Mich., and will remain as professor of mechanical engineering at the University of Michigan, Ann Arbor." . . . **Philippe Villers,** S.M.'60, president, founder and director of Automatix, Inc., Billerica, Mass., the first robotic systems company, was the keynote speaker at the National Engineers' Week Awards Luncheon in Boston on February 22, 1983, addressing the subject of "Intelligent Robotics Systems—A New Frontier."

Adrian Bejan, Ph.D.'75, professor of mechanical engineering at the University of Colorado, Boulder, has recently written *Entropy Generation Through Heat and Fluid Flow*, published by John Wiley & Sons. The textbook provides new insights on topics such as solar energy and conservation, aiming to bridge the gap between fluid mechanics, thermodynamics, and heat transfer.

John A. Meeks, S.M.'36, of Columbia, S.C., passed away on July 16, 1981; no details are available.

III

Materials Science and Engineering

John F. Elliott, Sc.D.'49, Professor of Metallurgy and Director of Mining and Mineral Resources Research at M.I.T., has been named honorary member by the American Institute of Mining, Metallurgical, and Petroleum Engineers.. . . **Jim-Yong Chi,** Sc.D.'79, joined GTE Laboratories, Waltham, Mass. in 1980. He reports that he has done research on semiconductor material and devices (both silicon and compound), and has two sons, seven and three-years-old, and a two-year-old daughter. . . . **Alan W. Swanson,** Ph.D.'72, is currently associate laboratory director of the Materials Laboratory at Gould Research Center, Rolling Meadows, Ill., directing research on III-V semiconductors.

Shiou C. Sun, Sc.D.'45, professor emeritus of Mineral Preparation at Pennsylvania State University and president of S.C. Sun Corp., passed away on November 16, 1981.

IV

Architecture

The department's Film/Video Section has received from Ampex Corp. a gift of video recording equipment that Ampex values at $275,000—a major new resource for exploring computer/video systems used interactively with humans in multimedia performances, says Gloriana Davenport of the section staff. At the same time, Ms. Davenport and Professor Richard Leacock have received a $47,857 grant from the National Endowment for the Arts to help meet the cost of a program to document how the 1984 World's Fair affects it host city, New Orleans. Filming has already begun and will continue over a three-year period, with the total cost estimated at $328,000. The goal, says Professor Leacock, is to show "how a city changes—how it happens, who does it, what factors operate—political, social, and economic. Not an easy subject," says Professor Leacock, "because a lot of it is talk and a lot of the process takes place behind closed doors. . . . I want to make a very sensual film that celebrates the way I like to look at things."

Masanori Nagashima, M.Arch.'76, writes, "I worked for Applied Research of Cambridge Limited (ARC) for five years (since October 1976.) In October 1981, I established a joint venture company (ARC Yamagiwa, Inc.), with ARC and Yamagiwa, Inc., in Japan of which I am a managing director. Our company is dealing with CAD computer software which is developed by ARC. Our users include Taisei Corp., which is one of the largest construction companies in Japan, and Misawa Home Co., Ltd., which is one of the largest housing companies in Japan."

V

Chemistry

Michael J. Abrams, Ph.D.'83, will continue his studies in inorganic chemistry at McMaster University, Canada, next fall under a NATO postdoctoral fellowship awarded by the National Science Foundation and the U.S. Department of State.

Dietmar Seyferth, professor of chemistry at M.I.T. who has been a "dominant figure" in the field of organometallic chemistry for some 20 years, now holds the **Robert T. Haslam** ('11) and **Bradley Dewey** ('09) Professorship in the department. The honor recognizes his broadly ranging research in the field, including the founding of the *Journal of Organometallic Chemistry* and the American Chemical Society's *Organometallics* magazine. Dr. Seyferth studied at the University of Buffalo and Harvard (Ph.D. 1955) and came to M.I.T. in 1957 after postdoctoral work at the Technische Hochschule in Munich.

Gary T. Forrest, Ph.D.'76, is currently products marketing manager for the Laser Analytics Division of Spectra Physics.

Paul Panagiotakos, Ph.D.'35, professor emeritus at Lowell (Mass.) Technological Institute and M.I.T., passed away on February 27, 1983. He was head of the chemistry department at Lowell Tech., professor of organic chemistry at M.I.T., and a professor at the New England School of Pharmacy, Boston. He was also a visiting professor at the Sorbonne, France and at the University of Baghdad. . . . **Helen T. Jones,** Ph.D.'25, of Salem, Mass., passed away on November 26, 1982; no details are available. . . . **Arnet L. Powell,** '52, of Wayland, Mass., passed away on November 23, 1982; no details are available.

VI

Electrical Engineering and Computer Science

Professor Mildred S. Dresselhaus will step down from her duties as director of the Center for Materials Science and Engineering on June 30, and a search committee is now seeking a successor. Dr. Dresselhaus, who is Abby Rockefeller Mauze Professor in the department, will increase her commitment to her own research when she leaves the center's administration; in general, her work has been in optical, electrical, and magneto-optical properties of solids, semiconductors, and semimetals. Professor Dresselhaus will also increase her activities with the American Physical Society in the coming year as its president-elect; she will be president in 1984-85.

To **Raymond A. Nash, Jr.,** S.M.'61, vice-president of Analytic Sciences Corp., Reading, Mass., the grade of Fellow in IEEE for "contributions to the analysis of integrated navigation systems." . . . **Nils R. Sandell, Jr.,** Ph.D.'74, president of Alphatech, and **Thomas P. Rona,** Sc.D.'55, of Boeing Aerospace Co. were among lecturers in a series on command, control, communications, and intelligence (C^3I) sponsored early this spring by the Boston Section of IEEE.

Professor **Thomas H. Lee,** associate director of the Energy Laboratory, was honored by IEEE early this year with the 1983 Haraden Pratt Award for "meritorious service in promoting public understanding of energy issues." . . . The grade of Fellow in IEEE has been given to Professor **Jerome H. Saltzer,** '61, "for contributions to the design of large-scale computer operating systems."

Arthur C. Smith, professor of electrical en-

Nabeel Hamdi and Reinhard Goethert, directors of the Laboratory of Architecture and Planning's Professional Practice Program, recently returned from Sri Lanka where they were guests of the National Housing Development Authority. Pictured is Dunstan Jayawardena, chairman; Susil Siriwardana, deputy general manager (Rural Housing), Mr. Goethert, Professor Hamdi, and Disa Weerapana, director for programming of the PPP. During their two-week mission the existing housing programs were reviewed as an initial introduction to a continuing involvement with the government's housing efforts. In addition, agreement was reached on a research project focused on developing options for low-income housing during Sri Lanka's coming five-year plan.

gineering who is graduate officer for the department, has been elected chairman of the faculty for a two-year term beginning this July. A major part of his job will be to chair the influential faculty Committee on Educational Policy.

Stephen T. Kent, Ph.D.'81, is currently senior scientist at Bolt Berenek and Newman, Inc., Cambridge, and in his second year as ACM national lecturer. . . . **I. R. Obenchain, Jr.,** S.M.'51, is currently program manager on a defense contract for TRW, and is living in McLean, Va. . . . **Karl I. Selin,** Sc.D.'55, reports that he is leader of Large Power System Group of Jet European Torus (JET). JET is a large Tokamak experiment near Abingdon, Oxfordshire, England. . . . **Pasquale V. Costa,** S.M.'69, former group vice-president of the Precision Scientific Group of the GCA Corp., Bedford, Mass., has been promoted to executive vice-president. . . . **Leroy F. Silva,** S.M.'54, is now Ball Professor of Engineering and Assistant Dean of Engineering for Industrial Relations at Purdue University.

John M. Tarrh, S.M.'72, has recently coauthored with Richard J. Thomas, *MHD and Fusion Magnets: Field and Force Design Concepts* (John Wiley & Sons, 1982). . . . **Kenneth E. McVicar,** S.M.'50, has been elected to the newly created position of vice-president for Plans and Programs at the MITRE Corp., Bedford, Mass. Formerly he was vice-president and general manager of MITRE's Command, Control, Communications and Intelligence Division (C^3I). . . . Also with the MITRE Corp., **Richard M. Harris,** S.M.'63, has been promoted from a division staff member of Naval Systems Engineering to associate technical director of the Naval Systems Engineering Division at its C^3I Operations, McLean, Va.

Arthur H. Ross, '40, a retired electronics engineer from Hershey, Penn., passed away on December 13, 1982.

VI-A Program

Another tops for the VI-A Program: This year's entering class will number 109—the largest in the program's 66-year history! These new students were selected from 225 applicants—the largest number ever to have applied.

This spring's applicants also represent a significant increase (10.5 percent) in the percent of Course VI sophomores applying for VI-A (60.7 percent)—compared to a year ago. This is also the highest percentage ever!

The participating companies, too, came up with their largest number of openings—127—in spite of the recessionary period. The EECS Department, though, had to limit the number of offers in order to keep the total size of the VI-A Program to a manageable number. It is expected this June will see 262 enrolled at the junior, senior, and graduate level in the program.

Congratulations to our illustrious VI-A graduate, **Cecil H. Green,** '23, founder of Texas Instruments, Inc. Cecil was made an honorary member of the Institute of Electrical & Electronics Engineers, Inc., by its board of directors in November 1982.

Congratulations, too, to a current VI-A graduate student, **Denice D. Denton,** '82, who is the recipient of a prestigious Fannie & John Hertz Fellowship for 1983-84. . . . **Michael A. Isnardi,** '82, is a recipient of a new Bell Laboratories Fellowship in its first year of establishment at M.I.T.

Stopping by for dinner, one evening, was **Allen K. Wells,** '80. Allen is with General Computer Co., Cambridge, Mass. . . . We also learn that **John D. Chisholm,** '75, is now employed by Grid Computer, Inc., in the San Francisco Bay area.

Visitors to the VI-A office since last writing have been: **Thomas Durgavich,** '75, employed by National Semiconductor, Santa Clara, Calif.; **James Marggraff,** '82, who is with Rolm Corp., Santa Clara, Calif.; and **Jose L. Valle,** '78, who is a senior engineer with Digital Equipment Corp., Maynard, Mass.—John A. Tucker, Director, VI-A Program, M.I.T., Room 38-473, Cambridge, MA 02139.

VII
Biology

Three members of the M.I.T. community have been honored as 1983 Searle Scholars; each will receive grants of $157,500 for research support for three years from the Searle Scholars Program of the Chicago Community Trust. The three: **Frederick W. Alt** of Columbia University, a postdoctoral fellow in the Cancer Research Center from 1977-82; **Daniel J. Donoghue,** Ph.D.'79, of the University of California at San Diego; and **Richard C. Mulligan,** '76, assistant professor of

Proposition 2 1/2: More Harm Than Good From Now On

After more than two years of studying Massachusetts' Proposition 2 1/2 in action, Professor Lawrence Susskind, Ph.D.'73, thinks it's time to back off. Continuing 2 1/2 will jeopardize the considerable gains that have been realized since the tax-cap legislation was put in place in January 1981 and bring unnecessary hardships to cities and their residents, he told a Harvard-M.I.T. Joint Center for Urban Studies audience early this spring.

Those who voted for Proposition 2 1/2 have a lot to cheer about: "property tax increases have been halted, spending levels capped, the business climate enhanced, and 100 percent evaluation achieved," Professor Susskind said.

But these gains have not been without costs. Though property tax levels have been reduced, overall tax reform hasn't yet materialized. In most towns budget authority has been centralized, with public involvement in the budget process "severely limited." Many people now pay for services that were formerly free. The public workforce is "demoralized, underpaid, and overworked." Interest rates are higher because the tax cap allegedly limits cities' ability to pay back debts. Service levels are falling. Deferred capital improvements may well be more costly in the future because of inflation.

These trends can only worsen in the next three years, says Professor Susskind, and he believes it's time to disengage. The way to do that is with the overall tax reform that many 2 1/2 advocates thought was assured by the proposition's original passage—"a master tax plan that puts the state more in line with the national average in reliance on various kinds of progressive taxes," he told the Harvard-M.I.T. seminar.

molecular biology at M.I.T. This support of newly established investigators in the biomedical field is made possible chiefly by trust funds established under the will of John G. Searle, president of G. D. Searle and Co., who died in 1978.

Alexander Rich, Sedgwick Professor of Biophysics, is corecipient of Brandeis University's $10,000 Rosensteil Medallion for 1983, one of the most presigious awards in basic medical research. Dr. Rich and Dr. Keith R. Porter, professor of cell biology at the University of Colorado, were cited for "profound biophysical contributions to understanding the structure of living cells." In Dr. Rich's case, the award citation noted his discovery that the double-stranded DNA molecule could exist in a left-handed spiral as well as the previously-known right-handed one.

The M.I.T. Center for Cancer Research is the beneficiary of a $500,000 research grant from Bristol-Myers Co., one of a series made by the company to major cancer research centers since 1977.

John Schindler III, Ph.D.'78, writes, "I am currently managing the clinical testing program at Ortho Pharmaceutical, evaluating the ability of anti-T cell monoclonal antibody to reverse rejection of renal allografts and to reverse or prevent graft virus host disease in leukemia patients who have received bone marrow transplants. This is the only large scale clinical program testing monoclonal antibodies for therapeutic use in humans and has produced several interesting results:

- ☐ Reversal of renal rejection has occurred in 99 percent of patients (72 out of 73).
- ☐ Administration of the antibody removes all circulating T cells in less than 15 minutes.
- ☐ Most patients develop antibodies to our antibody often after a two-week course of only 5 mg/day."

B. Russell Franklin, M.P.H.'34, of Venice, Fla., passed away on January 1, 1983; no details are available.

VIII

Physics

Charles R. Alcock and **Lennox L. Cowie,** both associate professors of physics at M.I.T., have been honored with two-year, $25,000 research fellowships from the Alfred P. Sloan Foundation for 1983-85; both work in the fields of space and astrophysics.

Peter T. Demos, Ph.D.'51, professor of physics who has guided the Bates Linear Accelerator in Middleton, Mass., from the idea stage 20 years ago to its present status as a major center for the study of nuclear structure, will retire as director of that facility on June 30, and a committee is now seeking his successor. Demos, who will be 65 in July, was director of the Laboratory for Nuclear Science from 1961 to 1973, when the Bates machine was completed and produced its first 400-MeV electron beam; last year its energy was boosted to 700 MeV.

Dorothy W. Weeks, Ph.D.'30, who was for 26 years professor of physics at Wilson College, Penn., has been honored as a leader in women's education by her alma mater, Wellesley College. . . . **Vincent Salmon,** Ph.D.'38, writes, "On my retirement from SRI International, and from Industrial Health (a company I helped to start) in 1976, I reactived myself as an acoustical consultant. Since then (1976), I have been a consulting professor at Stanford University, helping in acoustical activities."

James R. Downing, Ph.D.'42, a physicist for the National Aeronautical and Space Administration and a recipient of several awards for his work in the U.S. space program, passed away on December 31, 1982. Prior to his position as physicist, he worked on one of the first cyclotrons, researching the radioactive decay of iodine and assisted in developing the freezing techniques of whole blood.

X

Chemical Engineering

Jennie R. Patrick, Sc.D.'79, who began her education in a segregated school in rural Alabama and went on to receive M.I.T.'s doctorate in chemical engineering, has been honored by the CIBA-GEIGY Corp. as an "exceptional black scientist." Dr. Patrick's degree was the first chemical doctorate ever given to a black woman in the U.S., and her portrait by artist Ernest Crichlow now adorns a CIBA-GEIGY poster being given wide dissemination in schools and colleges. That suits Dr. Patrick just fine: a major concern is the lack of black instructors in the sciences and the resulting lack of role models for black students. Dr. Patrick studied at Tuskegee Institute and the University of California at Berkeley before coming to M.I.T., and she's now employed as a chemical engineer at the General Electric Research and Development Center in Schenectady, N.Y.

R. Robert Paxton, Sc.D.'49, has been appointed vice-president—Engineering and Planning at Pure Industries, Inc., St. Marys, Penn., a specialist in the manufacture of components made from carbon, silicon carbide, high temperature plastics, and sintered metals. He has authored several technical publications and a book which focuses on carbon technology; and is associate editor of *Lubrication Engineering*. . . . **George P. Perkinson,** Sc.D.'65, has been named a recipient of Cyanamid's 1982 Scientific Achievement Award, in recognition "for the development of a fully synthetic fermentation medium for production of an important new antibiotic." He is a group leader of the fermentation pilot plant of Cyanamid's Lederle Laboratories Medical Research Division, Pearl River, N.Y. . . . **Charles M. Donohue,** S.M.'61, has joined the Hilton-Davis Chemical Group of Sterling Drug, Inc., Cincinnati, Ohio, as president. He brings to the firm much experience in the management of chemical operations.

Isaac H. Munro, S.M.'35, of Fort Lauderdale Fla., passed away on July 5, 1982; no details are available. . . . **Gerald S. Rose,** S.M.'51, with the firm of Leydig, Voit, Osann, Mayer, & Holt, Chicago, Ill., passed away in January 1983.

Donald B. Anthony, Sc.D.'74, has been named vice-president and general manager of U.S. operations at the Pfaudler Co., Rochester, N.Y., which has taken over new ownership of the firm he has been employed with since 1975 (Sohio Industrial Products Co.). In his new position he will be responsible for current domestic operations and will direct the integration of Dorr-Oliver's Process Equipment Division. . . . **David Volt,** S.M.'68, reports that he has been promoted to vice-president—operations of Union Sugar Co., Santa Monica, Calif. . . . **Ray W. Harris,** S.M.'50, reports that he has retired.

Henry H. Rachford, Jr., Sc.D.'50, writes, "I retired on January 1, 1982, to devote full-time to Dupont-Rachford Engineering Mathematics Co., a company producing computer software for simulating pipeline performance. I had been at Rice University in the Department of Mathematical Sciences since 1964." . . . **Samuel W. Bodman,** Sc.D.'65, who has served as president since 1976 of Fidelity Management and Research Co., Boston, has been promoted to president and chief operating officer of FMR Corp., the Boston-based financial services organization known as the Fidelity Group. He will be responsible for overseeing the management of Fidelity Brokerage Services, the corporation's discount brokerage subsidiary; Fidelity Management & Research Co.; BOSCOMN, a marketing center for the information industry being developed on Boston's Commonwealth Pier; Fidelity Service Co.; and Fidelity Venture Associates.

XI

Urban Studies and Planning

Norma F. Satten, M.C.P.'45, is currently director of support services for Hospice of San Francisco. . . . **Alan P. Sager,** Ph.D.'79, reports that he has had published *Planning Home Care with the Elderly* (Cambridge: Ballinger Press, 1983).

Luis Unikel Spector, M.C.P.'58, of Mexico City, Mexico, passed away on January 25, 1981; no details are available.

XII

Earth and Planetary Sciences

Alexander de Bretteville, Jr., '42, a career scientist with the Army Signal Corps Laboratory at Fort Monmouth, N.J., passed away on July 19, 1982. A physicist and chemist with specialization in research into electrically active crystals was associated with the radiation laboratory at M.I.T.

from 1943 to 1945, then joining the staff of the Signal Corps Laboratory until his retirement in 1976. During his retirement he continued to play an active role in scientific colloquia—both national and state-wide (in New Jersey). . . . **Glenn J. Baker,** '34, of Calabasas, Calif., passed away on August 15, 1980; no details are available.

XIII

Ocean Engineering

Albert M. Bradley, Ph.D.'73, reports, "I continue to work at Woods Hole Oceanographic Institute, where I review instruments for research in physical oceanography, take them to sea, get wiped out (sometimes), and try again. I like working with the sea. You can't bull your way through!" . . . **Gerald E. Sheldon,** S.M.'76, is currently serving as Director of Ship Silencing for the Naval Sea Systems Command, Washington, D.C. . . . **Peter B. Bowman,** S.M.'73, is currently director of the Electrical Systems Group, Naval Sea Systems Command, Washington, D.C.

Nicholas Vytlacil, Jr., S.M.'55, of Soquel, Calif., passed away in October 1982; no details are available.

XIV

Economics

Professor Eric S. Maskin, whose work is in the field of social welfare functions and social choice, has received a two-year $25,000 research fellowship from the Alfred P. Sloan Foundation.

Donald Ratajczak, Ph.D.'72, professor of economics and director of the Economic Forecasting Project at Georgia State University, Atlanta, has been named 1983 Distinguished Professor from the College of Business Administration by the GSU Alumni Association. He has made major contributions in the teaching field as well as being an accurate forecaster of economic conditions. . . . **John Turnbull,** Ph.D.'47, writes, "retired in 1982 after 40 years of teaching economics—35 of which were as Professor of Economics at the University of Minnesota. Never lost my interest in the out-of-doors—so of all things—I am a volunteer naturalist at a local nature center." **William E. Kline,** '42, writes, "I retired from McGraw-Hill in 1978 and am now self-employed as a writer and consultant in the field of educational testing."

XV

Management

Janet A. Millenson, S.M.'76, writes, "I am working at Sperry as manager of market planning for Office Information Systems." . . . **Jonathan P. Moynihan,** S.M.'77, is chairman of Moynihan Strategy Consultants, a New York-based consulting firm, specializing in financial and strategic advice to Fortune 100 Corporations. . . . **Dorothy F. Osborn-Walton,** S.M.'76, reports that she is second vice-president at Continental Illinois Bank and is married, and has a one-year-old child. . . . **Kevin K. Steiner,** S.M.'79, is currently secretary/treasurer of Steiner Corp., and president of Steiner Capital (a venture capital subsidiary of Steiner Corp.). His first son Robin, was born on July 29, 1982.

Melford E. Monsees, '58, is currently coordinator at the University of Missouri Graduate Engineering Program, Kansas City; an associate of Richard Muther and Associates, Inc.; and a member of the M.I.T. Educational Council. . . . **Sharon L. Holcombe,** S.M.'74, reports that she is owner of Leslind Marketing Service, a company providing Washington D.C. representatives in marketing and technical services for firms world-wide. Also she is married to H. Judson Holcombe and has two daughters, Leslie (six years old), and Lindsey (age three-and-one-half years old). . . . **Joseph Iemolo,** S.M.'62, completed two years as president of the M.I.T. Club of Delaware Valley and assisted in coordinating the Philadelphia Alumni Officers Conference of October 1982. He is currently an active member of the M.I.T. Executive Committee and of the alumni M.I.T. Club of Delaware Valley and is manager of scientific marketing for the Sperry Computer Division of the Sperry Corp. . . . **Steven E. Shapiro,** S.M.'75, has been appointed manager of finance at Southern Pacific Satellite Co., McLean, Va.

Steven Mendelsohn, S.M.'71, is currently principal and partner at Goss, Gilroy and Associates, Ottawa, Canada. The firm specializes in management consulting in information and control, economics and econometrics, statistic and survey design, program evaluation, and market research.. . ., **John F. Fort,** S.M.'66, former senior vice-president of Tyco Laboratories, Inc., Exeter, N.H., has now become its president, chief executive officer and director. . . . **Sergio Brosio,** S.M.'73, writes, "In 1980 I founded ITP Boston, Inc., of which I am currently president. The company designs, develops, and markets software products and systems for factory automation. Products include: engineering work stations, failure diagnostic systems, plant monitoring, and operator interfaces. The company also supplies integrated computer systems for process control, material handling management, plant scheduling, and supervisory control systems for flexible automation."

Donn Swartz, S.M.'74, joined Goodyear International in November 1981 and was assigned to the Sao Paulo (Brazil) factory as production superintendant from November 1981 to February 1982. Recently he was transferred to the Buenos Aires (Argentina) factory as assistant production director in March 1983. . . . **Virgil F. McCaleb,** S.M.'76, is currently president of McCaleb Enterprise and is vice-president of Star Associates, and resides in Gautier, Miss. . . . **Steven J. Alexander,** S.M.'78, has been promoted to manager of Logic Test Design at Amdahl Corp., where is is completing his fifth year.

Nari M. Deboo, S.M.'69, is currently employed as assistant vice-president in charge of financial planning and budgeting at American Express International Banking Corp., New York City. . . . **Christopher Von Brawn,** S.M.'74, is presently working in the area of industrial analysis for Siemens Ag, Tokyo, Japan, and reports that he is leading a fascinating life, comparing western and eastern business culture. . . . **Ollie J. Akel,** S.M.'67, writes that in September 1981 he became managing director of Essochem Impex (an Exxon affiliate), Brussels, Belgium. . . . **Fred I. Steel,** Ph.D.'65, reports that he had written two books in 1982, both published by CBI Publishing Co., Inc. (Boston): *The Sense of Place* and *The Role of the Internal Consultant*.

Howard P. Sharp, '34, writes, "I retired (partially), but am still doing part-time management consulting. I now have two M.D.'s in the family—my son Phil, my daughter Barbara (who married an M.D.), and a daughter Janet, a social worker with an M.D. who married a lawyer in New York City." . . . **Bertram Shlensky,** S.M.'70, is currently president of Talbott Knitting Mills, Inc. . . . **Assen Nicolov,** S.M.'77, writes, "Recently, we started one of the most ambitious projects so far undertaken for the development of the Alaska bottom fish resources. This past summer, our company, Inlaks Seafood Corp., of which I am the president, purchased through its subsidiary, Alaska Brands Corp., one of the most sophisticated fish factory vessels in the world—the *Golden Alaska* —and is now marketing Alaska cod and Alaska pollock nationwide. Our newly established subsidiary today employs about 90 people in Alaska, Seattle, and New York City.

Bernell K. Stone, Ph.D.'69, reports that he is editor of the *Journal of Cash Management* and academic administrator for the National Corporate Cash Management Association. . . . **Geoff Brooks,** S.M.'79, recently established a consulting practice called Brooks & Co., specializing in resource planning. . . . **Mark K. Rosenfeld,** S.M.'70, former executive vice-president of Jacobson Stores, Inc., Jackson, Mich., has been promoted to president. . . . **Michael De Marco,** S.M.'68, has recently been promoted to vice-president—finance of Citicorp Industrial Credit, Inc.

Paul R. Freshwater, S.M.'68, is currently regional manager of state and local government relations at Procter and Gamble, Cincinnati; he is also vice-president of the Charter Committee of Greater Cincinnati. . . . **Lawrence Kilham,** S.M.'66, writes, "I have purchased from the ex-parent corporation the essential parts of the company I used to manage. Our new name is MPM Polymer Systems, Inc., Clifton, N.J., and we engineer, manufacture, and sell specialized plastic extrusion machinery. We presently have a large backlog of orders from the laboratories of plastic raw materials companies." . . . **Larry LaFranchi,** S.M.'71, division controller for Analog Devices Semiconductor, Norwood, Mass., has been promoted to group controller—components, responsible for consolidating the planning and reporting of the five divisions within the components groups.

John B. Scouller, S.M.'61, of North Granby, Conn., passed away on August 4, 1982; no details are available.

Sloan Fellows

Fifty-four new Sloan Fellows—the Class of 1984—have entered the school, and Alan F. White, director of the Sloan Fellows Program, sees two trends of interest in the class: fully 10 percent of the new class are foreign national employees of U.S. corporations, and their sponsorship is seen as "an important part of the continuing internationalization of these businesses," according to Mr. White; and almost 20 percent of the new class are women (10 years ago there were no women in the program). In all, 18 of the new Sloan Fellows are from overseas, six of them from Japan. No M.I.T. alumni are included.

James J. McGowan, S.M.'66, has been elected comptroller of the Ohio Bell Telephone Co. He has been with Ohio Bell since 1955 and was made Bell's assistant vice-president for corporate planning in 1977, and three years later was elected vice-president—centralized services. . . . **Victor R. MacDonald,** S.M.'68, director—communications at International Business Machines Corp. (IBM), Armonk, N.Y. has been elected to the additional post of corporate vice-president, with responsibilities including IBM's advertising, internal and external information activities, promotional programs and publications. . . . **Carroll M. Martenson,** S.M.'54, chairman and chief executive officer of the Criton Corp., has taken on the additional post of director the Precision Castparts Corp., Portland, Ore.

Thornton A. Wilson, S.M.'53, chairman and chief executive officer of the Boeing Corp., has taken on the additional post of director of the Weyerhaeuser Co., Tacoma, Wash. . . . **Willis S. White, Jr.,** S.M.'58, chairman and chief executive officer of American Electric Power Co., has taken on the additional post of director of the Irving Bank Corp., and Irving Trust Co. (a unit), New York City.

Senior Executives

Joseph E. Clancy, '74, president of Bridgeport Machines, Bridgeport, Conn., a division of Textron, Inc., has recently been appointed to the additional post of trustee of Peoples Savings Bank (Bridgeport). . . . **Dorman M. Miller,** '68, is retiring from the post of vice-president—marketing and customer service of the American Electric Power Service Corp., a subsidiary of American Electric Power Co., Columbus, Ohio.

Robert L. King, '68, senior vice-president—marketing and traffic for the Southern Pacific Co., San Franciso, Calif., passed away in November 1982.

XVI

Aeronautics and Astronautics

Luat T. Nguyen, S.M.'68, an aerospace technologist in the Low-Speed Aerodynamics Division at NASA's Langely Research Center, Hampton, Va., was the recipient of the 1983 Lawrence Sperry Award bestowed by the American Institute of Aeronautics and Astronautics. He was recognized "for the development of control system concepts that have become widely accepted and used in current generation fighter aircraft for improving maneuverabilty and departure/spin resistance."

William H. Cullin, S.M.'47, is currently an adjunct professor on the faculty of the Naval Postgraduate School, Monterey, Calif. He has also published the third edition of *How to Conduct Foreign Military Sales: The United States Guide* (National Affairs, Inc., of Washington, D.C.). . . . **Harry Sauerwein, Jr.,** Sc.D.'60, writes, "I am now director of business development at the Ballistic Missile Defense at the Orlando, Fla. operations of the Martin Marietta Corp.

Charles D. Robson, '41, of Durham, N.C., passed away in August 1982; no details are available.

XVII

Political Science

Professor Ithiel D. Pool is the author of two books published early this year: *Forecasting the Telephone: A Retrospective Technology Assessment* (Ablex Publishing Corp., $21.50) and *Technologies of Freedom: On Free Speech in an Electronic Age* (Belknap Press of Harvard University, $20). In *Forecasting the Telehone*, Professor Pool compares forecasts made about the telephone at the time of its invention with the reality of its social implications after 100 years. *Technologies of Freedom* is a study of the implications of the electronic media—cables, computers, videodisks, and satellites—for the freedom of communications that has been so carefully nutured under conventional print technology.

XVIII

Mathematics

Steven A. Mitchell, C.L.E. Moore Instructor in Mathematics at M.I.T. since 1981, has received a National Science Foundation postdoctoral research fellowship for 1983-84 under which he'll pursue mathematical studies at Princeton. Dr. Mitchell's doctorate is from the University of Washington (1981).

A two-year, $25,000 research fellowship has come from the Alfred P. Sloan Foundation to **David A. Vogan, Jr.,** Ph.D.'76, associate professor of mathematics, whose research and teaching are in the field of algebra and number theory.

XIX

Meteorology

More than 200 alumni and other former colleagues joined in honoring the memory of the late **Professor Jule G. Charney** at a scientific program at M.I.T. last March 31. Speakers, each dealing with different aspects of Professor Charney's contributions to atmospheric science, included **Joachim Kuettner** of the World Meteorological Organization (Geneva), Professor **Richard Lindzen** of Harvard, Professor **Edward N. Lorenz,** Sc.D.'43, of M.I.T., Professor **Dennis Moore** of the University of Hawaii, **Joseph Pedlosky,** '59, of the Woods Hole Oceanographic Institution, **Norman Phillips** of the National Meteorological Center in Washington, D.C., **Jagadish Shukla** of the Goddard Space Flight Center, and **Henry Stommel** of the Woods Hole Oceanographic Institution. But the highlight was an evening performance of chamber music in Professor Charney's memory by the Apple Hill Chamber Players of East Sullivan, N.H.

As most readers know, Professor Charney was a distinguished member of the M.I.T. faculty from 1956 until the time of his death in 1981; he was widely honored as one of the leading contributors to post-World-War-II meteorology—a pioneer in the use of computers in forecasting, in the analysis of complex meteorological and oceanographic phenomena, and in building mathematical models of weather and climate. In 1974 the American Meteorological Society, which cosponsored with the department the symposium of March 31, cited Charney as "more than any other living figure" the scientist responsible for the evolution of modern meteorology.

Edward N. Lorenz, Sc.D.'43, former head of the Department of Meteorology and Physical Oceanography at M.I.T. was the 1983 corecipient of the Crawford Prize of the Royal Swedish Academy of Sciences, in recognition of his "fundamental contributions in the field of geophysical hydrodynamics that in a unique way contributed to our understanding of the large-scale circulation of the atmosphere and the sea." . . . **David T. Prophet,** S.M.'51, writes, "Still actively investing in and managing real estate rental property and have expanded from Florida into Georgia, Texas, and California."

XXII

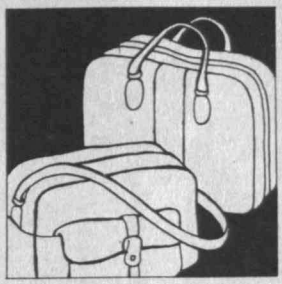
Nuclear Engineering

Plans for the department's 25th anniversary celebration, set for next October 7 and 8, are now well advanced. There will be a symposium on nuclear engineering on October 8, with speakers including **N. J. Palladino,** chairman of the Nuclear Regulatory Commission, followed by a 25th anniversary banquet in honor of **Manson Benedict,** Ph.D.'55, founding head of the department. Two weeks later, on October 17-19, the 25th anniversary of the M.I.T. Research Reactor will be observed by an international symposium on the use and development of research reactors under the direction of Professor **Otto K. Harling,** '77, director of the Nuclear Reactor Laboratory.

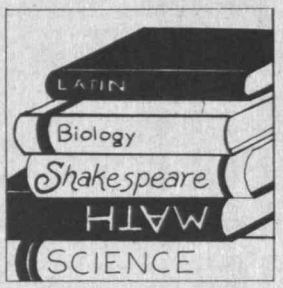
Stephen C. Jones, Ph.D.'77, is currently research assistant professor in neurology and radiology at the University of Pennsylvania. . . . **William T. McCormick, Jr.,** Ph.D.'69, is currently president of the American Natural Resources Co., Detroit, Mich., a firm which operates interstate gas pipelines (among other businesses). . . . **John K. Buckner,** S.M.'60, formerly vice-president and financial officer of Prime Computer, Inc., Natick, Mass., has become president and general manager of Prime Computer CAD/CAM business group. . . . **Richard E. Storat,** S.M.'67, former chief project engineer at Bethlehem Steel Corp., Bethlehem, Penn., has been promoted to manager, corporate energy affairs in the Purchasing Department.

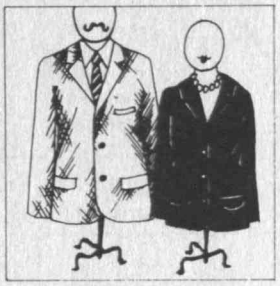
Technology and Policy Program

Kris Horvath, S.M.'78, has accepted a position with ARAMCO, Dhahran, Saudi Arabia. . . . **Lawrence Zwimpfer,** S.M.'81, has recently acquired a position in the Telecom Marketing Unit (a publicity planning unit) in the head office of the post office, Wellington, Australia. . . . **Carrick Davidson,** S.M.'80, presently at the University of Texas Law School, Austin, has started the Environmental Law Society there.. . . **Patty Joffee,** is joining Pequod Associates, Boston, an executive placement firm.—Richard de Neufville, Chairman, Technology and Policy Program, M.I.T., Room 1-138, Cambridge, MA 02139.

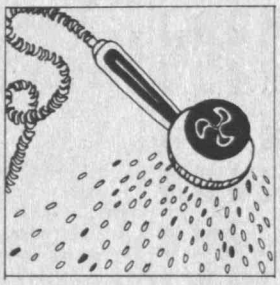


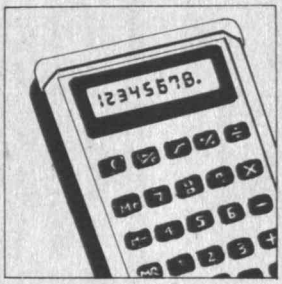
Things for reading, things for packing, things for speeding,

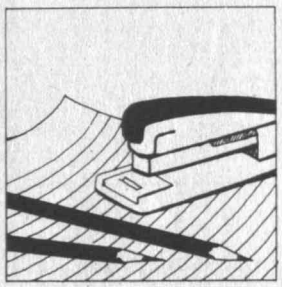




things for cracking. Things for playing, things for dressing,







things for spraying, things for guessing. Things for duty,

and things for soup, things for beauty at

the Coop

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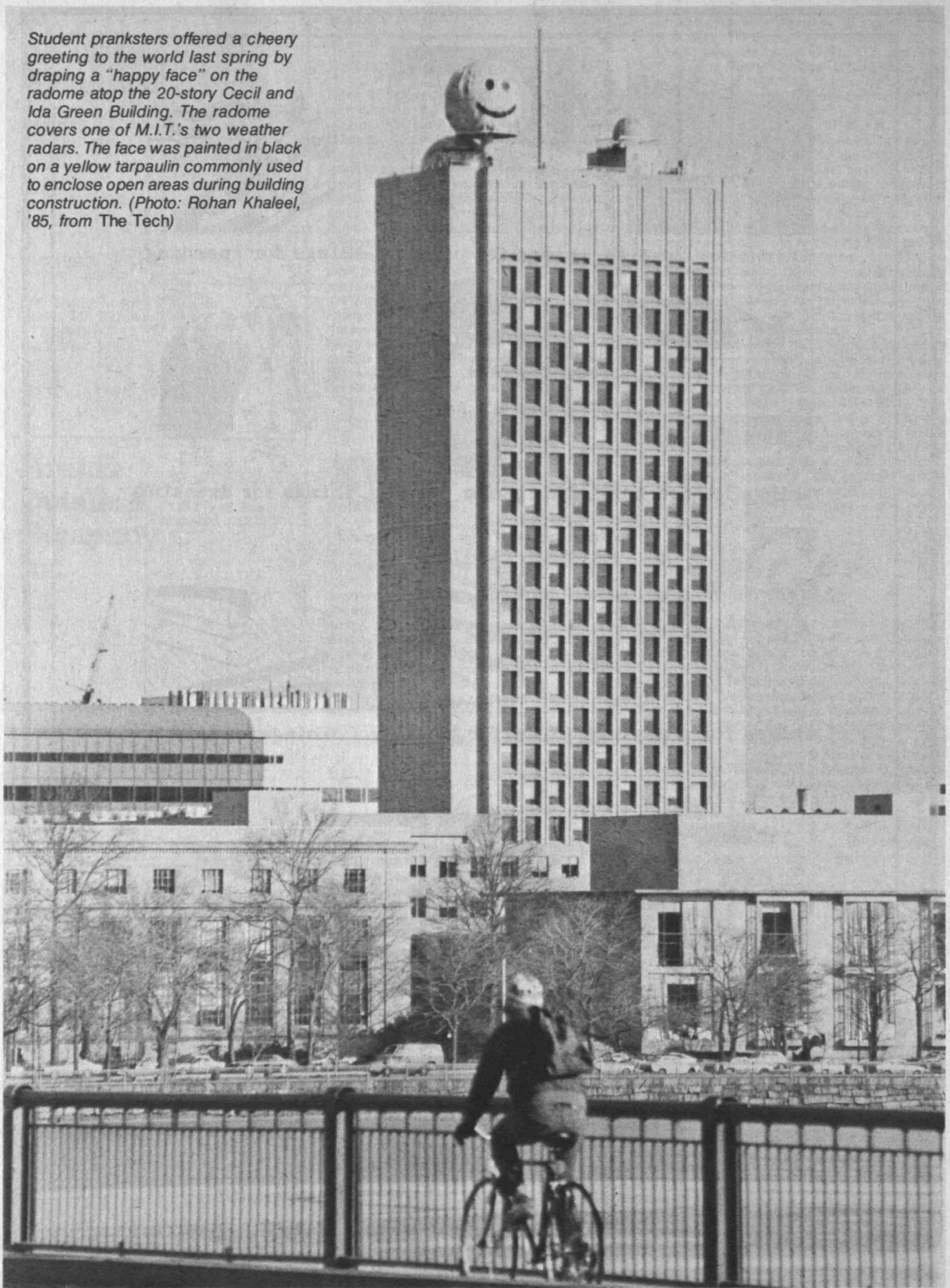
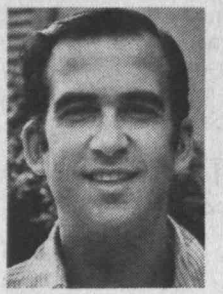
M.I.T. Student Center



Student pranksters offered a cheery greeting to the world last spring by draping a "happy face" on the radome atop the 20-story Cecil and Ida Green Building. The radome covers one of M.I.T.'s two weather radars. The face was painted in black on a yellow tarpaulin commonly used to enclose open areas during building construction. (Photo: Rohan Khaleel, '85, from The Tech*)*

Puzzle Corner
Allan J. Gottlieb

How Many Ways to Play Bridge?



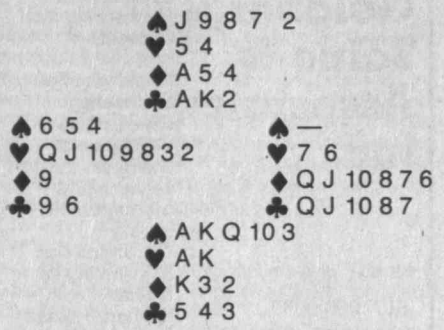
Allan J. Gottlieb, '67, is associate research professor at the Courant Institute of Mathematical Sciences of New York University; he studied mathematics at M.I.T. and Brandeis. Send problems, solutions, and comments to him at the Courant Institute, New York University, 251 Mercer St., New York, N.Y., 10012.

Our son David had his first birthday a few weeks ago (March 14), and he continues to run all around our city apartment and country house. But this activity (as well as lots of others) has been somewhat hindered by the heavy rains this April; I conclude that New York will have a great many flowers this May (and that Mississippi will be awash in blooms).

The published version of **F/M 1** contained a serious misprint, and the (corrected) problem is reopened. Solutions to the revised problem will appear in November/December.

Problems

JUL 1 A bridge problem from Winslow Hartford: Given the hands shown at the top of the next column, South is to make six spades, with the opening lead from West ♥Q.



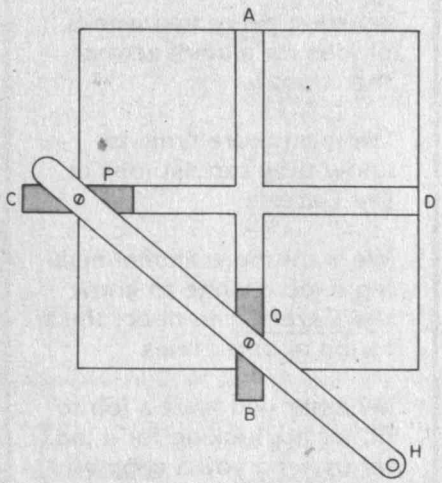
JUL 2. Although this problem from Jerry Grossman depends on the rules of bridge, I am classifying it as combinatorial: The number of ways the play of a hand of bridge can proceed obviously depends on the distribution and trump choice. Can some reasonably tight upper or lower bounds be found? How about an average case analysis?

JUL 3. A pair of cryptarithmetic puzzles from Avi Ornstein: Nine is a square, and while NINETEEN isn't actually a prime, at least its smallest factor is greater than 150.

TWO + TWENTY = TWELVE + TEN

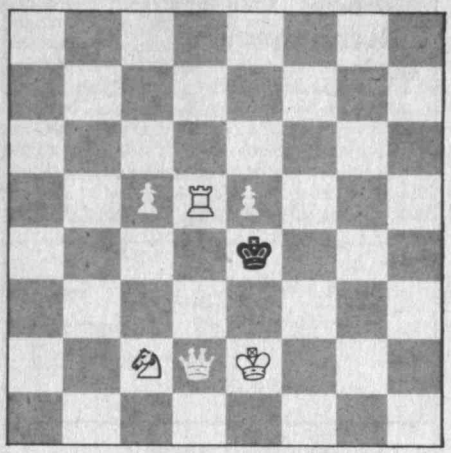
(The first three are all divisible by their namesakes.)

JUL 4. Anthony Stanton has a block of wood with slots AB and CD, as shown. In each slot is a wooden piece, P and Q, that can slide in it. Also shown is a bar attached by loose screws to P and Q and extended to a handle H. Is it possible to rotate the handle through a full 360 degrees without having P and Q collide? If this is possible, is the orbit of H an ellipse?



JUL 5. Our Japanese friend Nob Yoshigahara sent us the following list of the first 19 perfect squares containing two distinct digits and not containing a zero. What are the next two elements of the sequence?

$4 \times 4 = 16$
$5 \times 5 = 25$
$6 \times 6 = 36$
$7 \times 7 = 49$
$8 \times 8 = 64$
$9 \times 9 = 81$
$11 \times 11 = 121$



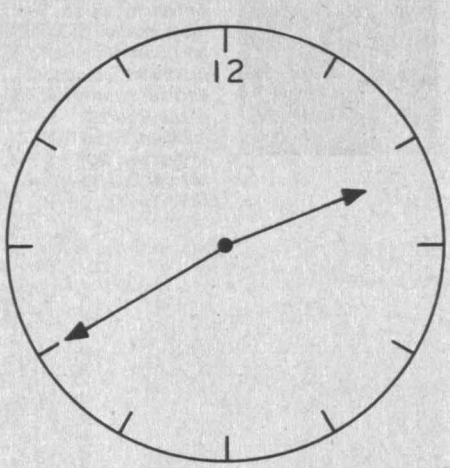
See problem F/M 1, next page

$12 \times 12 = 144$
$15 \times 15 = 225$
$21 \times 21 = 441$
$22 \times 22 = 484$
$26 \times 26 = 676$
$38 \times 38 = 1444$
$88 \times 88 = 7744$
$109 \times 109 = 11881$
$173 \times 173 = 29929$
$212 \times 212 = 44944$
$235 \times 235 = 55225$
$264 \times 264 = 69696$

F/M 1. Elliot Roberts and Richard Hess noticed that no solution was possible. Inspecting the proposers' solution, I am able to deduce that the Black queen and pawns should be White. The problem is therefore reopened; White is to mate in three.

Speed Department

JUL SD1. Smith Turner writes: I am told that a clock (which I am not shown) is 1 hour and 20 minutes fast, that the minute and hour hands are interchanged, and that it is placed on the wall behind me. On the wall in front of me is a mirror I can't see, but I see the image on this mirror reflected from a plate glass cover on my desk top. The desk top image is shown below. What is the correct time?

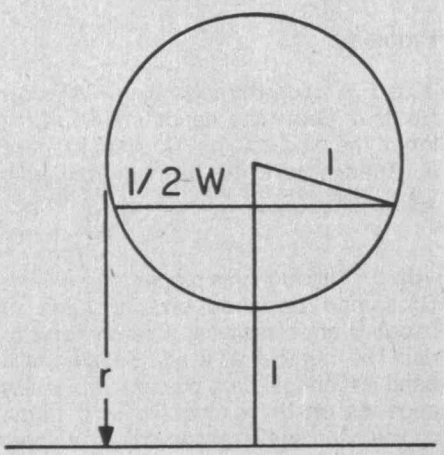


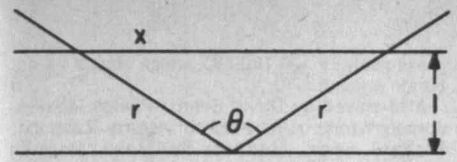
JUL SD2. You are given a three-pint jug and two five-pint jugs, all three empty, and an eight-pint jug full of wine. Divide the wine into two equal portions.

Solutions

F/M 2. Let T be the torus obtained by rotating the circle $(x - 2) + y = 1$ in the x-y plane about the y-axis. Let B be a plane tangent to the torus T at the point (0,0,1). Find the volume and surface area of the small region obtained by slicing T with P.

The following solution is from Matthew Fountain: The smaller part of the torus has a volume approximately 13.03 and a total surface approximately 33,029. The flat portion of the surface is exactly 8.





The volume of a figure of revolution is $\int \theta$ wr dr, where w is the width parallel to the axis of the figure at distance r from the axis, and θ is the angle of revolution of that width. The width of the torus is $w = 2\sqrt{1 - (r-2)^2}$ and $\theta = 2\sec^{-1}r$, making the smaller part of the torus contain a volume equal to

$$4\int_1^3 r\sqrt{1-(r-2)^2}\sec^{-1}r\,dr = 13.03$$

when evaluated by Simpson's rule. The flat surface is

$S_f = \int w\,dx$, where

$x = \sqrt{r^2-1}$ and $dx = r/[\sqrt{r^2-1}]\,dr$. Then

$$S_f = 4\int_1^3 r\sqrt{1-(r-2)^2}/[\sqrt{r^2-1}]\,dr$$

$$= 4\int_1^3 r\sqrt{3-r}/\sqrt{r+1}\,dr.$$

Substituting $t^2 = r + 1$ results in

$$S_f = 8\int_{\sqrt{2}}^2 (t^2-1)\sqrt{4-t^2}\,dt = 2$$

$$|-t(4-t^2)^{3/2}|_{\sqrt{2}}^2 = 8.$$

The curved surface is

$S_c = \int r\,\theta\,ds$, where

$$(ds)^2 = (dw/2)^2 + (dr)^2$$

$$= [(r-2)^2(dr)^2]/[1-(r-2)^2] + (dr)^2$$

$$= (dr)^2/[1-(r-2)^2]. \text{ Then}$$

$$S_c = 4\int_1^3 [r\sec^{-1}r]/[\sqrt{1-(r-2)^2}]dr.$$

The substitution of $r = 2 + \sin\phi$ converts this to

$$S_c = 4\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} (s + \sin\phi)\sec^{-1}(2+\sin\phi)d\phi =$$

25.029 when evaluated by Simpson's rule.

F/M 3. Solve the simultaneous equations:
$x^6y = (y^2+1)x^3$
$y^6x = 9(x^2+1)y^3$

The following solution is from Charles Sutton:
If we discount the trivial solution $x = 0$, $y = 0$, we may divide the equations by x^3 and y^3, respectively, to obtain

$$x^2(xy) = y^2 + 1$$
$$y^2(xy) = 9(x^2+1) \quad (1)$$

Now make the change of variables

$$xy = u$$
$$y/x = v \quad (2)$$

from which we obtain

$$x^2 = u/v$$
$$y^2 = uv \quad (3)$$

and equations (2) become $u^2/v = uv + 1$ and $u^2v = 9(u+v)/v$ which, when cleared of fractions, give

$$u^2 = uv^2 + v \quad (4)$$
$$u^2v^2 = 9u + 9v \quad (5)$$

Multiplying the first equation by 9 and subtracting the second gives $9u^2 - u^2v^2 = 9uv^2 - 9u$ which, when solved for v^2, gives

$$v^2 = \frac{9u^2+9u}{u^2+9u} = \frac{9u+9}{u+9} \quad (6)$$

From (4) we have $v = u^2 - uv^2 = u^2 - (9u^2 + 9u)/(u+9) = (u^3 - 9u)/(u+9)$ so $v^2 = (u^6 - 18u^4 + 81u^2)/(u+9)^2$ and substituting this in (6) gives $(u^6 - 18u^4 + 81u^2)/(u+9)^2 = (9u+9)/(u+9)$ which when cleared of fractions gives $u^6 - 18u^4 + 81u^2 = 9u^2 + 90u + 81$, or

$$u^6 - 18u^4 + 72u^2 - 90u - 81 = 0 \quad (8)$$

We see from (1) and (2) that xy, and hence u, must be positive. Equation (7) is found to have one positive root, located between 3 and 4, and using a calculator, the value of this root is found to be $u = 3.888908631$. It follows from (3) that v must be positive and from (6) we find $v = 1.847647602$. Knowing u and v, we can calculate x^2 and y^2 from (3). Finally, we see from (2) that x and y must have the same sign. Thus the nontrivial solutions are

$$\begin{cases} x = 1.45078915 \\ y = 2.68054709 \end{cases} \quad \text{and}$$

$$\begin{cases} x = -1.45078915 \\ y = -2.68054709 \end{cases}$$

Reino Hakala wondered what MACSYMA (a noted computer software system for algebraic manipulation) would do on this problem. As it happens, Leo Harten did use MACSYMA on his solution, and he reports that after 45 CPU seconds, using its standard solver, MACSYMA found the three solutions given above and ten involving complex numbers. The proposer Norman Wickstrand notes that for a very similar (in appearance) set of equations

$(X^6+1)Y = (Y^2+1)X^3$
$(Y^6+1)X = 9(X^2+1)Y^3$

the solution is "solvable by radicals." Readers desiring a copy of Mr. Wickstrand's solution to this should write to the editor.

Also solved by Harry Zaremba, Emmet Duffy, Richard Hess, Matthew Fountain, Irving Hopkins, Frank Carbin, and Jordan Wouk.

F/M 4. A pilot flies south over a spherical earth a distance D, flies due east a distance D, and then flies due north a distance D, arriving back at precisely the starting point. For D equal to the radius of the earth, find all solutions for the starting latitude.

The following countably infinite number of solutions are from Avi Ornstein:
The most obvious solution would be to start at the North Pole. Flying D miles south, then due east, and then north would return to the North Pole. An infinite set of solutions are also possible, however. They would entail starting at a point, flying D miles south, then circling the world an integral number of times in D miles (thereby being at the same point), and then returning D miles north again to the starting point. The formula for the circumference of a circle drawn on the surface of the earth is 2 D sin (r/D), where D is the radius of the earth and r is the radius of the circle. Centering the circle at the South Pole, we can rearrange the equation to be r = D arcsin (1/2 n). The set of solutions would then be D + r, where n is set for the number of times the pilot would circle the world. The fact that the world is not actually a sphere means that slight modification would be required. Likewise, the length of a degree of latitude varies between the equator and the poles, but the error would not be too significant.
The first seven distances north of the South Pole happen to be 1.160D, 1.080D, 1.053D, 1.040D, 1.032D, 1.027D, and 1.023D. The answer is ap-

proximately $(1 + 0.160/n)D$, which should be accurate enough.

Also solved by David Evans, Phelps Meaker, Jordan Wouk, John Woolston, Harry Zaremba, Richard Hess, Matthew Fountain, Norman Wickstrand and Emmet Duffy.

F/M 5. A vertical plumb line is hung down the center of a one-mile-deep mine shaft in Borneo. A rock is dropped from next to the top of the plumb line. How far from the bottom of the plumb line will the rock land, if we ignore friction?

Our final solution is from John Prussing: Consider a coordinate system with its origin at the center of the earth. Because Borneo lies on the equator, let the x axis point out the mine shaft, the z axis point out the North Pole, and the y axis complete the right-handed frame. This frame rotates with the earth, and to someone looking down the shaft, the y axis points eastward. The absolute acceleration of the rock is $-ge_x$, where g is the (constant) gravitational acceleration and e_x is a unit vector along the x axis. The acceleration vector of the rock relative to the rotating frame a is given by

$a_r = -ge_x - w x (w x r) - 2 x v_r$

where w is the angular velocity vector of the earth, r is the position vector of the rock from the center of the earth, v_r is the velocity vector of the rock relative to the rotating frame, and ^{x} represents the cross product. From this equation the components of a_r are found to be

$d^2x/dt^2 = w^2x + 2w\, dy/dt - g$

$d^2y/dt^2 = w^2y - 2w\, dx/dt$

$d^2z/dt^2 = 0$

where w is the magnitude of the angular velocity of the earth and x, y, z are the components of the position r. The solution to these equations for initial conditions $x(0)$ = earth radius $= R$, $y(0) = z(0) = 0$, and all initial components of velocity relative to the rotating frame $= 0$ is

$x(t) = (R - g/w^2)(\cos a + a \sin a) + g/w^2$

$y(t) = (R - g/w^2)(a \cos a - \sin a)$

$z(t) = 0$

where $a = wt$. The boundary condition at the final time T is $x(t) = R - 1$ miles. Using a value of earth radius $R = 3960$ miles, the value of a which satisfies the boundary condition is 1.320×10^{-3} and $y(t) = 4.647$ feet. Thus, the rock lands this distance east of the plumb line.

Also solved by Sidney Shapiro, David Evans, Ronald Raines, Bob Pease, Harry Zaremba, Emmet Duffy, Norman Wickstrand, Matthew Fountain, Richard Hess, John Woolston and the proposer, Bruce Calder.

Better Late Than Never

1982 OCT5. David Dreyfuss found a simpler solution.

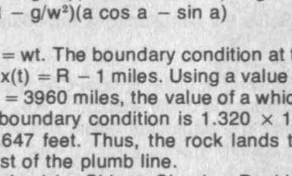
N/D 3. Sidney Shapiro has responded.

N/D 5. Sidney Shapiro has responded.

1983 JAN3. Rick Decker has responded.

Proposer's Solution to Speed Problem

JUL SD2. The following diagram demonstrates the process:



	3	5	5	8
Initial	0	0	0	8
8-5	0	0	5	3
5-3	3	0	2	3
3-5	0	3	2	3
8-5	0	5	2	1
5-3	3	2	2	1
5-5	3	0	4	1
3-8	0	0	4	4

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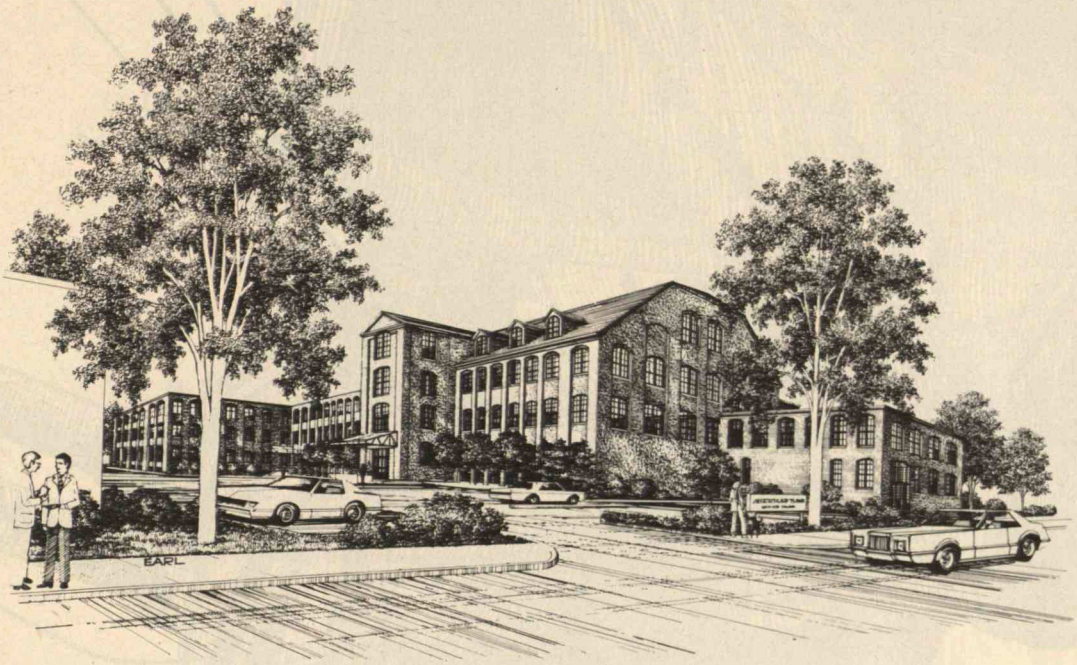

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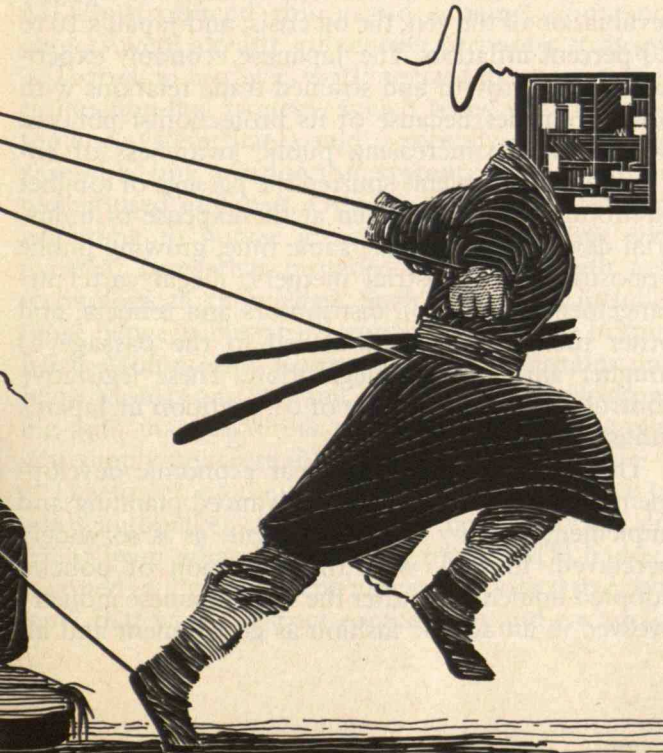
The Myth of Japan Inc.

BY TOSHIMASA TSURUTA

In Japan, government controls all industrial development—or does it? Some of her most prosperous industries owe their very success to the government's failure in achieving total control.

MANY observers of Japan are convinced that the major ingredient behind Japan's economic success has been the cooperative relationship between government and industry. One American management consultant, James Abegglen, believed so strongly in the reality of that marriage that he coined the phrase



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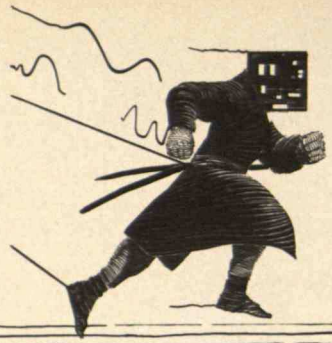


"Japan Inc." in 1970. It has stuck in the public mind ever since.

The Japanese government did play an important role in Japan's postwar recovery. But the forces of a decentralized market system also played a crucial part. Japan developed a postwar economy that, like many Western nations, was dependent on two main pillars: parliamentary democracy and the competitive forces of the marketplace. Those two forces kept the government from interfering excessively in Japan's economic development, particularly in industries that were most directly linked to domestic market demand, such as automobile manufacturing. Together, those forces saved Japan from becoming a nation with a rigidly controlled economy. Indeed, Japan's industries became internationally competitive precisely because the demands of the domestic marketplace encouraged a spirit of innovation and enterprise.

The reputation of Japan's Ministry of International Trade and Industry, the "notorious MITI," is partly to blame for the impression that Japanese industry is controlled by the government. The fact that there are still 27 products under import control or subject to high import duties also contributes to this impression. Many of these products, including oranges, beef, leather, bananas, chocolates, whiskies, and marine products, are prime exports for businesses in North America and Europe. The fact that U.S. businesses cannot enjoy the same benefits in Japan that Japanese businesses enjoy in the United States further grates on Westerners' sense of fair play. Americans, for instance, are prohibited from attending conferences on data communications in Japan, while the Japanese are free to participate in similar endeavors in America. There is no question that the Japanese government exerted powerful and apparently successful controls over Japan's import economy. But it did not achieve a similar dominance over Japan's domestic market and exports.

The Era of Japan Inc.

Japan's postwar industrial policy has gone through three distinct stages. During the first phase in the 1950s, the government intervened directly to promote industrial recovery. Through legislation and carefully formulated policies, MITI, created in 1949, attempted to protect its young industries by placing import quotas on a broad range of products and restricting investment by foreign firms. It also funneled funds to industry though the Japan Development Bank and other government-run financial institutions. In addition, it granted business preferential tax treatment in the form of tax cuts. The term Japan Inc. best fits this early period of reconstruction.

In the second phase, the 1960s, import curbs on industrial products such as steel, electronics, and machinery were slowly lifted, with only 87 products still under control by 1963. Foreign companies were also permitted to directly invest in Japanese firms under the condition that they would not take their investment returns out of Japan.

Despite this gradual process of liberalization, MITI remained reluctant to open Japan's market. Government officials believed that Japan's primary industries, including automobiles, steel, and petrochemicals, were not sophisticated enough to compete with foreign-made goods. Only under concerted pressure from foreign companies did MITI agree to lift some import restrictions and allow limited foreign investment.

The third stage of industrial policy came in the 1970s, with the economic fallout from the upward revaluation of the yen, the oil crisis, and Japan's 10 to 20 percent inflation. The Japanese economy experienced slow growth and strained trade relations with other countries because of its protectionist policies. Within Japan, increasing public awareness of environmental problems spurred the passage of tougher environmental laws—often at the expense of industrial development. At the same time, growing public opposition to industrial mergers, illegal cartel arrangements among oil distributors and refiners, and other monopolistic actions led to the passage of tougher antimonopoly legislation. These legislative controls enhanced the role of competition in Japan's industrial policy.

Thus, the pattern of postwar economic development was not one of careful advanced planning and implementation by the government, as is so widely perceived. Instead, with the exception of policies adopted immediately after the war, Japanese industry evolved in an ad hoc fashion as government and in-

The government grudgingly changed its industry-first slant to a policy that acknowledged the value of human life and the need to protect the environment.

dustry leaders attempted to cope with individual problems as they arose.

The Free Market at Work

The forces of Japan's marketplace began to exert their influence in the early 1950s. In the years immediately after the war, government intervened primarily in basic industries producing key materials such as steel and petrochemicals. By the time MITI got around to intervening in industries more directly linked to consumer demand, it was too late for strong government control.

In 1952, the government did succeed in curbing automobile imports under a strict quota system. Those import controls, which continued until October 1965, did help Japan's automobile industry stand on its own feet. But when MITI tried in 1955 to shape the development of the auto industry directly with a plan to build a "national car," it went too far.

The plan sought to have a single company mass-produce an ultrasmall popular car that was both inexpensive and exportable. MITI proposed to grant the manufacturer of such a car financial aid and legal protection in a bid to increase employment, improve technical know-how, and lay the groundwork for an automobile export industry. However, by the time MITI introduced this grand scheme, consumer choices were already influencing corporate strategy.

Toyota, in fact, was working hard to set up its own production-line strategy, which relied on a new automatic system that would eventually eclipse Ford's assembly-line production system, then the most widely used in Japan. Other major companies were beginning to pursue growth through linkups with overseas firms that provided each party with new technological knowledge. Such exchanges included those between Nissan Motors and Austin of Britain, Isuzu Motors and Rootes Motors of Britain, and Hino Motors and Renault of France. To these growing auto manufacturers, the MITI national-car plan was simply unacceptable.

The forces of the marketplace ultimately led Japan's automakers into a growth pattern totally different from what MITI had in mind. MITI had envisioned a "government-industry cooperative system" that would restrict competition and encourage mergers to nurture the infant industry. Instead, the success of Japan's automobile industry was fueled by competition that helped improve product quality, reduce prices, and diversify car lines in a way that would never have been possible under MITI's original blueprint.

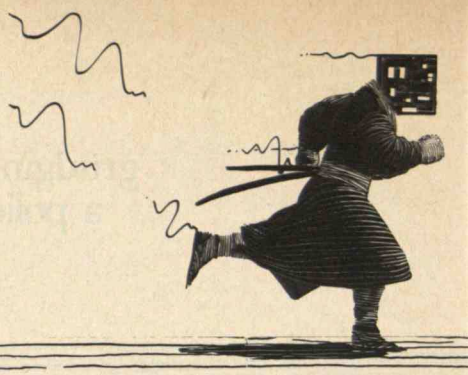
The Merger Movement

But even as individual automakers were making these choices, MITI was planning yet another bid at government control. In June 1961, MITI announced a plan calling for consolidation of automakers into three groups, each composed of two or three existing manufacturers. One group was to consist of mass producers, with each firm specializing in one car model. The second group was to be composed of manufacturers producing only specialty cars such as sports and luxury models, and the third group would manufacture minicars. The consolidation plan was designed to curb new entries into the car market and generate mass production under a rigid government design.

MITI's consolidation efforts were based upon the simple assumption that the larger the business, the better its capabilities in operations and marketing would be. Government officials were also concerned about the mergers then occurring between major companies in Western Europe and the United States. They were afraid that Japan's fledgling industries would not be able to compete, either domestically or internationally, with the corporate giants of the West.

When MITI announced its consolidation plan, existing automobile manufacturers were already beginning to compete with different car models. Such latecomers as Toyo Kogyo, which makes Mazdas, and Mitsubishi Motors had just introduced several new ultramini passenger cars. In the late 1960s, Honda Motors, a motorcycle producer, entered the car market. To compete with these new entries and meet the growing market demand, leading automakers such as Toyota and Nissan produced a number of new models to complete their model line.

Today, there are nine car manufacturers in Japan. No other country has so many automakers, each conducting manufacturing operations individually. Clearly, such a highly competitive situation evolved



from a development path far different from the one envisioned by MITI. Only in 1969, when Mitsubishi and Chrysler announced a joint venture, did MITI recognize that its plan for consolidating the automobile industry was unrealistic. Even then, MITI officials thought the linkup was premature. One prominent government official went so far as to call the arrangement a "totally regrettable development."

Putting the Lid on Oil

The government failed to achieve strong controls in the auto industry—to the ultimate benefit of that industry. Conversely, in the oil refining industry, the government did attain substantial control—with disastrous results.

MITI's involvement in that industry began with the passage of the Oil Business Law in 1962. That law was similar to other bills proposed by MITI to help nurture specific industries, but it was the only major piece of legislation to win passage. A year later, for example, MITI proposed another bill aimed at strengthening, through consolidation and merger, such key industries as steel and petrochemicals. But the bill was killed because of strong objections from these industries; they feared government control and wanted no part of MITI's grand plan.

The Oil Business Law was designed to prevent foreign oil firms from entering the domestic market following the decontrol of crude oil imports. The law was also designed to beef up domestic oil companies by permitting MITI to intervene directly in a broad range of corporate operations. For example, it required any company entering the oil-refining industry or installing new equipment to obtain MITI's approval. The law also obliged companies to submit plans detailing their use of crude oil imports and their output of petroleum products. The law authorized MITI to recommend changes in the output of these companies depending upon the current supply-demand situation and to set standard prices on oil products.

Under the Oil Business Law, the oil-refining industry was never permitted to grow under the dictates of a free-market system. MITI refused to allow larger foreign companies to compete in Japan and instead permitted too many small-scale domestic distributors and refiners to enter the field. By stifling competition from overseas, MITI hoped to give domestic refiners the chance to grow and become competitive on an international scale. Instead, the result was a severe gap in Japan's ability to procure crude oil, refine it, and market it at competitive prices. Under government control, the oil-refining industry also lost its ability to adapt to economic reality and was particularly hard-hit by the oil crunch of the early 1970s. Even worse, government restrictions dampened the corporate initiative and originality so essential to success.

The Public Presence

The evolution of Japan's Antimonopoly Law illustrates the distinct shift in government policy over the last three decades—from one that reflected a strong protectionist bias to one that allowed marketplace forces to dominate.

During the 1950s, support for antimonopoly policies was in retreat. Passed in 1947, the law was revised in 1953 to ease restrictions on cartels and trusts. For example, some industries were allowed to set retail prices at given levels and to form cartels. Curbs on stock ownership and the holding of concurrent posts by board members of competing companies were also eased, making it easier for large companies to control their markets. And mergers between trading companies and financial institutions were allowed.

Through the late 1950s and early 1960s, antimonopoly policy continued to mirror the government's industry-first bias. But by the late 1960s, public opinion had begun to force a change in policy. The Japanese public was becoming increasingly disgruntled with the monopolistic actions of its government and industrial leaders. This growing tide of public awareness coincided with the gradual easing of import restrictions and limits on foreign investment, and both movements served to make the Japanese economy more competitive.

The battle over the proposed merger between Yawata and Fuji steel companies is a good example of the changing tide. Proposed in 1968, the merger symbolized the government's intent to consolidate industry and had full government support. Yet it drew a chorus of objections from many economists,

Like other industrialized countries, Japan is facing the difficulties of maintaining a self-reliant economy at home and competing for technological supremacy abroad.

consumer groups, and other private interests. These groups feared such a merger would further stifle competition and eventually lead to increased prices for cars and other consumer goods. They voiced their objections in numerous newspaper and magazine articles, marking the first time that the Japanese press joined forces to tackle a major economic issue. This was also the first time a merger plan was disputed under the strictures of the 21-year-old Antimonopoly Law.

Subjected to a trial before Japan's Fair Trade Commission (FTC), the merger was allowed only after the two firms accepted the FTC's conditions. These required both companies to divest themselves of other operations, including railing, tinplate, sheet plating, and pig iron for cast products. It took one and a half years to hammer out a mutually satisfactory ruling on the case, and MITI officials were stunned. They had never expected the Antimonoply Law to be such a barrier to government policy.

Punishing the Monopolies

In the 1970s, industry continued to violate even the weakened provisions of the Antimonopoly Law, further angering the Japanese public. The unauthorized setting of resale prices for electrical appliances by Matsushita Electric Industrial Co. and Sony Corp., for instance, bolstered public support for a more stringent antimonopoly law. The rush of illegal cartel arrangements within the oil industry immediately after the oil crisis in 1973 had the same effect. Responding to public consternation, Japanese parliamentary leaders introduced a bill to strengthen punitive measures against monopolistic practices, including the imposition of surcharges on cartels and the tightening of controls over corporate stock holdings. The bill finally passed the Diet under the Fukuda administration in 1977, producing the first reinforcement of the Antimonopoly Law since it passed in 1947.

At the same time, public concern over environmental abuse was growing. Japan was rapidly becoming an economic power and with its growth came urban congestion and pollution. Between 1971 and 1973, Japanese residents filed four major suits against local industries, accusing them of failing to meet their social responsibility in curbing pollution. The residents won all four cases. In one suit, not only were the petrochemical firms involved held responsible for the pollution, but the state and provincial governments were considered negligent as well in not enforcing environmental laws. This trial, concluded in 1973, represented a turning point in the government's attitude toward the environment. Its industry-first slant grudgingly gave way to a policy that acknowledged the value of human life and the need to protect the natural environment.

From Steel to High Tech

In changing its industrial policy to fit the times, MITI came up with a novel plan to develop knowledge-intensive industries. The plan, announced in May 1971, sought to place the technologically sophisticated processing industries—such as the manufacturing of electronics, automobiles, and precision machinery—at the heart of Japan's industrial structure. But economic upheavals of the 1970s—the oil crisis and resulting increases in oil prices—disrupted implementation of this plan. At the same time, they forced the adjustments in industrial structure that MITI had envisioned—but under the harsher, more entrepreneurial conditions of the market.

For instance, under the intensely competitive conditions of the Japanese economy in the 1970s, it was almost impossible for companies to pass on oil-price increases to consumers. Instead, companies learned to maximize productivity through technological gains to absorb these increased costs. In such a competitive economy, technical progress ensured corporate existence and growth.

Because of the increase in oil prices, Japan also lost its competitive edge in several important manufacturing industries. For instance, those companies that produced petrochemicals and fertilizer from costly imported oil fared unfavorably in competition with North American firms that used lower-cost natural gas as a raw material. Similarly, companies that used oil to produce electricity for operations such as aluminum smelting lost the competitive edge to American, Canadian, and Australian firms that relied on hydroelectric power and coal-based heat.

At the same time, Japan's newer, knowledge-

intensive industries were able to grow by expanding their export market. Gradually, the bulk of employees and capital in Japan shifted from the basic industries to the processing industries. For example, in 1965, 58.6 percent of Japan's workers were employed in basic industries, compared with 41.4 percent in processing industries. By 1978, the numbers had dropped to 46.9 percent in basic industry and climbed to 53.1 percent in the processing firms. The disparity was even more dramatic by 1981: Japan's processing industries were producing twice as many products as its basic industries. Of all the industrialized countries, Japan has made the most rapid shift from an economy based on standardized, high-volume production to one relying on sophisticated skills. And that is the main reason for Japan's formidable success today in producing specialty consumer goods.

The Japanese government did play some role in that transition by helping its basic industries reduce in size. In 1978, for instance, government officials enacted a five-year law designed to help industries caught in the protracted recession to dispose of surplus equipment and plants. Japan's FTC also permitted some basic industries to form cartels and cut back on production in a joint effort to reduce overall capacity. But these moves were basically ad-hoc responses to the deepening decline of Japan's traditional industries. The actual pace of change was determined by the marketplace.

For example, the aluminum smelting industry had been capable of producing 1.6 million tons of ingot during its high-growth period in the 1960s. But when the industry began to lose its competitive edge to the imports that poured into Japan after the oil crisis, its members jointly decided to dispose of surplus equipment and plants, slashing their total capacity to 1.1 million tons. The second oil crisis worsened the competitive situation, and in 1981 MITI recommended that the aluminum smelting industry further reduce its capacity to 700,000 tons by 1985. But with fierce competition from foreign companies, the actual pace of adjustment was even faster than MITI expected. Some of the nation's major aluminum smelters decided to withdraw partially or totally from domestic smelting, and by 1982 the industry's capacity had shrunk to 300,000 tons.

The Future Is Knowledge

And what of MITI's future role? Having learned some hard lessons in the last decade, the government will probably leave most aspects of economic development to the private sector. The government will likely limit major intervention to areas not ruled by the market—such as health care, social welfare, and other public services.

MITI should, however, make a greater effort to ease Japan's import restrictions to placate foreign companies, who are pressuring their governments to impose restrictions on Japanese goods. The government should also continue to promote technical progress through government-backed research and development. In one of Japan's most ambitious efforts, MITI has joined with industry in a ten-year, billion-dollar drive to build computer systems that approach a human level of intelligence. Industry is supplying only a small fraction of the funding; most of the $50 million promised for the next three years will come from MITI's coffers.

Despite this impressive collaboration, foreign observers overestimate the degree to which government controls Japan's industrial policy today. Most of the country's industrial activity is developing without the hand of government, and Japan is moving farther and farther away from the image of Japan Inc. The power of the marketplace no longer allows the all-inclusive government control of the 1950s or even the development of a single-minded economic plan for the future.

Like other industrialized countries, Japan is confronting the difficulties of maintaining a balanced, self-reliant economy at home and competing for technological supremacy abroad. But at this juncture, she has lost sight of her future course and is drifting through the 1980s like a ship lost at sea.

TOSHIMASA TSURUTA is professor of economics at Senshu University in Kawasaki City and a senior economist at Japan's Research Institute of National Economy. This article was adapted from a paper presented in November 1982 at a M.I.T. conference on "Effective Business Management: Lessons from Japan."

To Trust or Antitrust

BY RICHARD CORRIGAN

"My lawyer told me not to do it," Bobby R. Inman, flashing a smile, said to the gathering on Capitol Hill.

Inman, now head of the ambitious new research and development enterprise, Microelectronics and Computer Technology Corp. (MCC), was speaking at a late-afternoon reception for congressional leaders. The affair was hosted by MCC and its 12 sponsoring companies to show off Inman, former deputy director of the CIA, as their chairman and chief executive officer.

In recounting his lawyer's advice to steer clear of MCC, Inman touched lightly on the antitrust issues surrounding joint R&D ventures among U.S. corporations. From all indications, these issues are going to be explored quite seriously by the 98th Congress, as the high-technology sector and its congressional allies push for a relaxation of current antitrust laws.

The formation of MCC represents the most visible response thus far by American computer and semiconductor manufacturers to intense competition from Japan. By agreeing to pool some of their R&D dollars in MCC, the sponsors have demonstrated their concern about the Japanese penetration of domestic and world markets. They have also acknowledged that they would be less able to stave off the challenge by operating alone.

But in setting up MCC, the companies are making themselves vulnerable to potential antitrust suits. The Antitrust Division of the Justice Department gave preliminary approval to the joint venture, but, as is its custom, reserved the right to object later. As one industry representative put it, the department merely said, "We're not going to prosecute *now*." "That's not very heartening," the representative added. And the department's statement did not foreclose the possibility that a private party would bring a suit against MCC for alleged anticompetitive behavior.

Lending substance to this possibility, antitrust attorney Joseph M. Alioto of San Francisco, in a letter last January to MCC's founders, called their venture "an unequivocal combination in violation of the antitrust laws" that would stifle communication and retard innovation in the electronics industry. Alioto accused the Justice Department of abdicating its enforcement responsibilities in the antitrust area, and he issued an implicit threat to bring a private suit against MCC's formation. But so far no such challenge has surfaced.

The Great Debate

Since the era of the great trusts, Washington has engaged in periodic debates over how extensive trade restraints should be. The Sherman Antitrust Act of 1890, the Clayton Antitrust Act of 1914, and subsequent amendments were enacted amid outcries over corporate monopoly and collusion. As recently as the mid-1970s, in a flareup of antitrust sentiment, Congress argued heatedly over legislation designed to force the breakup of major oil companies. One divestiture bill nearly passed the Senate, but the issue was eventually dropped after intensive lobbying from the oil companies.

Today, the mood in the nation's capital, as the country emerges from the latest recession, is markedly different. Democrats and Republicans alike seem to agree that the current "scattershot" approach to R&D entails too much time, money, and duplication, and that the American economy requires a more coordinated approach. A search is underway for just such a national strategy, and there is keen interest in trying to foster a closer partnership among business, labor, and government—with Japan serving as a model of success.

In contrast with U.S. tradition, the Japanese government has sought to promote and guide its industries, not to restrain and regulate them. Japan's Antimonopoly Law of 1947 was imposed by the occupation government of General Douglas MacArthur, and Japan's Ministry of International Trade and Industry (MITI) has regarded the law as an unwanted intrusion. For the last three decades, the Japanese government has effectively nullified that law while leaving it nominally intact. Government-subsidized R&D ventures involving government agencies, industrial clusters, and academic centers are common to the Japanese economic system, especially in high technology.

The Japanese government, for example, has instituted a national project to help Japanese computer firms produce a supercomputer 1,000 times faster than today's state-of-the-art American model by the end of this decade. In a parallel but longer-term effort, the Japanese government and industry are jointly sponsoring research on a so-called "fifth-generation" computer that comes closer to a human level of intelligence.

Few advocate a centralized, government-controlled system for the United States along these lines. But there is substantial support for less sweeping initiatives to bolster American industry—such as the easing of antitrust laws for privately funded R&D. Members of both parties in the House and Senate have introduced bills in this vein, and the Justice Department has offered its own proposal.

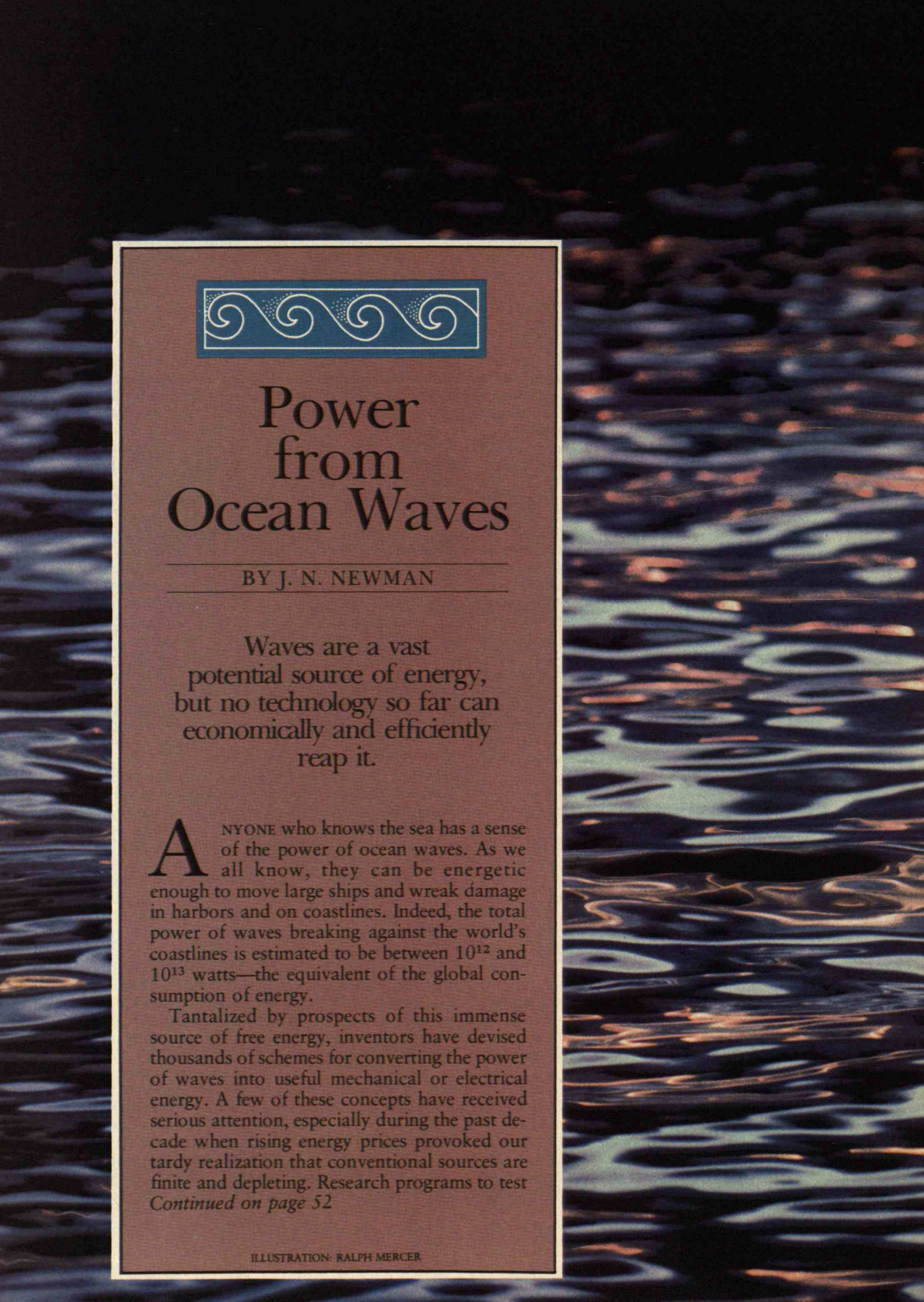
Sen. Paul E. Tsongas, D-Mass., for instance, has introduced a bill that would provide legal immunity to joint ventures that obtain advance clearance from the Justice Department. To qualify for immunity, such ventures would have to comply with restrictions such as mandatory licensing of patents to outside applicants after six years.

Rep. Don Edwards, D-Calif., has sponsored a similar bill that would grant immunity to approved plans from suits by federal agencies. Private parties could still sue but would be restricted to seeking single instead of triple damages. Another approach, sponsored by Sens. Charles McC. Mathias, R-Md., and Mike Synar, D-Okla., would give joint R&D ventures immunity from public or private suits so long as they meet certain standards on membership, market shares, and plant licensing. Still other variations have been prepared by Democratic presidential contenders Sens. John Glenn of Ohio and Gary Hart of Colorado and by freshman Rep. Ed Zschau, R-Calif., a former high-tech entrepreneur.

The Justice Department's proposal, meanwhile, would amend current law by precluding antitrust challenges to joint R&D ventures as *per se* violations—that is, they would not automatically be open to attack. Instead,

Continued on p. 68

RICHARD CORRIGAN is a staff correspondent for National Journal, *the Washington weekly on government and politics.*



Power from Ocean Waves

BY J. N. NEWMAN

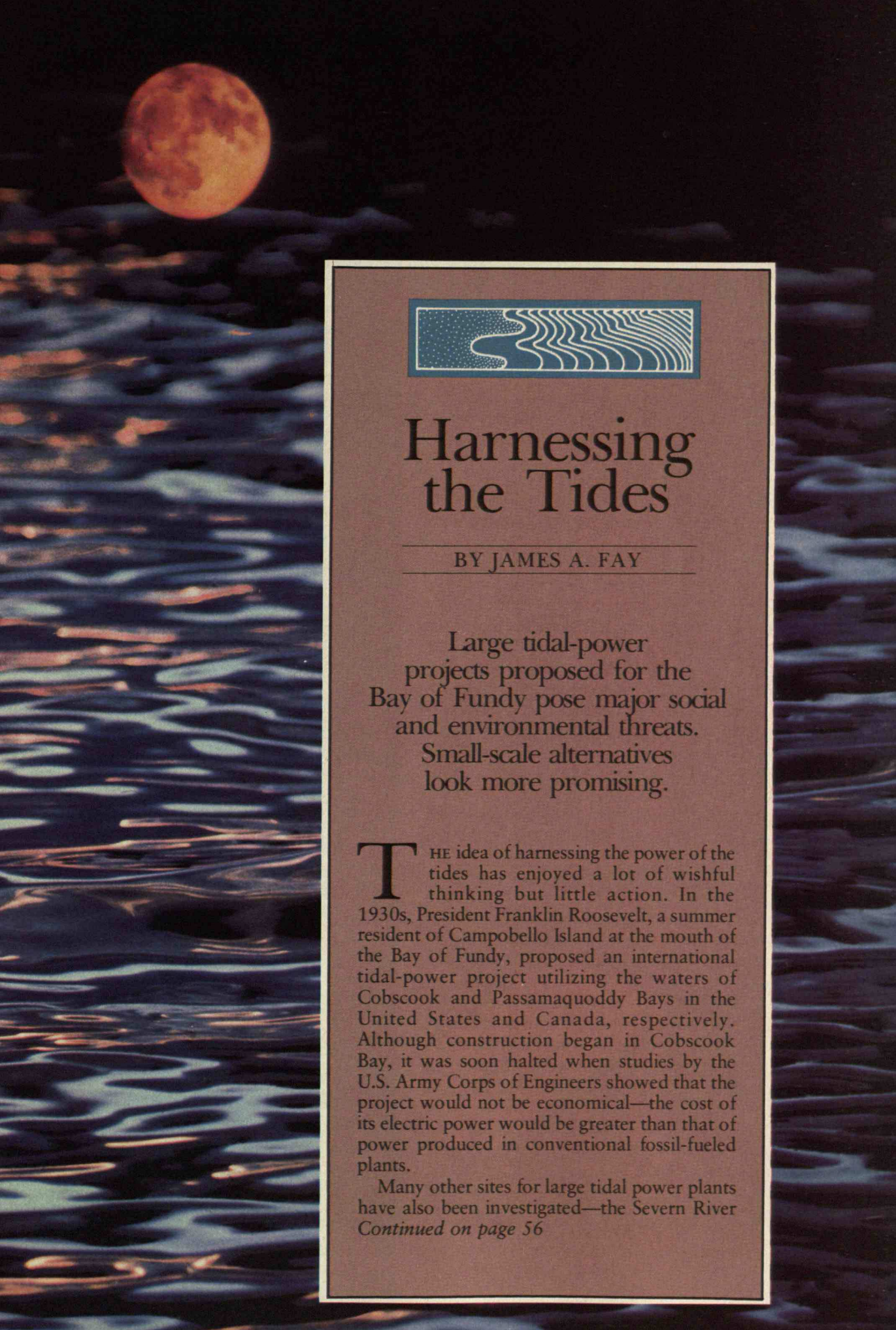
Waves are a vast potential source of energy, but no technology so far can economically and efficiently reap it.

ANYONE who knows the sea has a sense of the power of ocean waves. As we all know, they can be energetic enough to move large ships and wreak damage in harbors and on coastlines. Indeed, the total power of waves breaking against the world's coastlines is estimated to be between 10^{12} and 10^{13} watts—the equivalent of the global consumption of energy.

Tantalized by prospects of this immense source of free energy, inventors have devised thousands of schemes for converting the power of waves into useful mechanical or electrical energy. A few of these concepts have received serious attention, especially during the past decade when rising energy prices provoked our tardy realization that conventional sources are finite and depleting. Research programs to test

Continued on page 52

ILLUSTRATION: RALPH MERCER



Harnessing the Tides

BY JAMES A. FAY

Large tidal-power projects proposed for the Bay of Fundy pose major social and environmental threats. Small-scale alternatives look more promising.

THE idea of harnessing the power of the tides has enjoyed a lot of wishful thinking but little action. In the 1930s, President Franklin Roosevelt, a summer resident of Campobello Island at the mouth of the Bay of Fundy, proposed an international tidal-power project utilizing the waters of Cobscook and Passamaquoddy Bays in the United States and Canada, respectively. Although construction began in Cobscook Bay, it was soon halted when studies by the U.S. Army Corps of Engineers showed that the project would not be economical—the cost of its electric power would be greater than that of power produced in conventional fossil-fueled plants.

Many other sites for large tidal power plants have also been investigated—the Severn River

Continued on page 56

the design and economic feasibilty of several different devices have been conducted in Japan, Norway, and Great Britain.

Integrators of the Wind

The energy in ocean waves comes from the wind. The ultimate source is solar radiation, which powers the wind by differentially heating the atmosphere. Like solar energy and the wind itself, wave energy is widely distributed and diffuse. And like solar energy, it can be collected in substantial quantities only by large devices or arrays. But unlike solar collectors that gather heat, these devices collect the mechanical energy of wave motion, which must be converted to some other form to be stored. Also, compared with fossil-fuel-powered engines, wave machines must work with relatively low velocities and large forces.

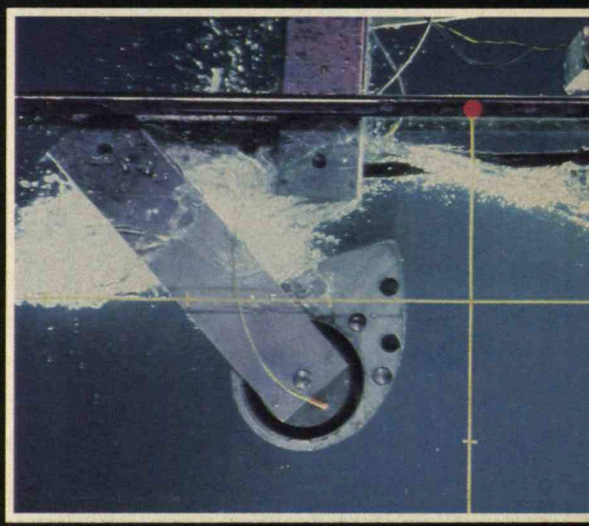
Another drawback of wave energy is that, like most forms of solar energy, it is intermittent. But wave power has one advantage: it is not subject to the rapid variations typical of wind energy. Much of the total available wave energy is associated with long swells generated by the wind over distances of thousands of miles and periods of days. The effects of small variations in the wind are lost as the energy is transported conveniently to our coasts.

The physics of waves give this energy form another more subtle but important advantage: it is much more constant than wind energy. Waves not only persist long after the wind that caused them has calmed, but their energy content increases as the square of their height—six-foot waves contain four times as much energy as three-foot waves, for example. In contrast, the power output of wind is proportional to the cube of its velocity—a 60-mile-per-hour wind contains eight times more energy than a 30-mile-per-hour wind.

Still, despite these two advantages over wind, waves remain a diffuse and variable source of energy. Under normal ocean conditions, waves deliver an average of between 10 and 100 kilowatts of power on every meter of beach in the mid-latitudes. But in a severe storm, 1 megawatt per meter may arrive on the same coastline. Thus, any device for harvesting wave energy must be capable of operating successfully—or at least surviving—under a wide range of conditions.

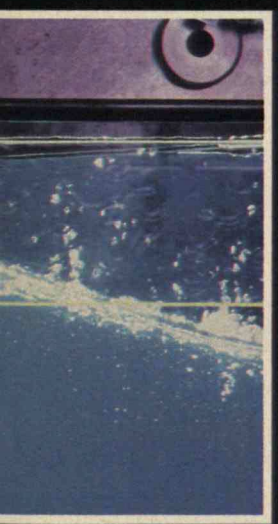
The Technical Problems

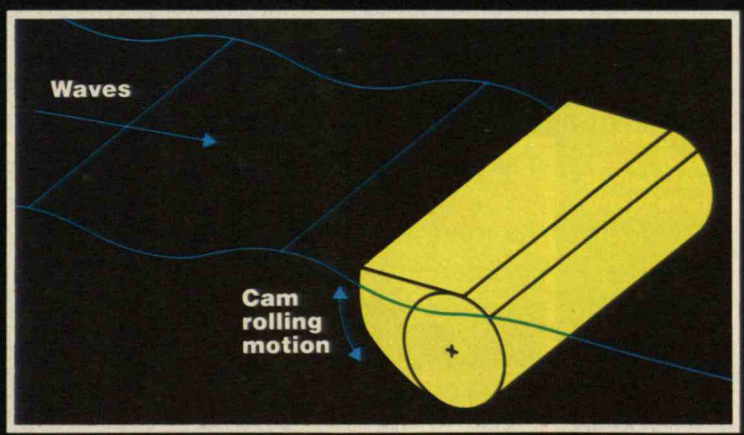
In its ultimate form, a wave-power system must per-



The asymmetrical shape of the "Salter duck" causes it to rock when an incoming wave strikes it. If the natural nodding frequency of the duck can be made equal to the natural frequency of the waves, their energy can be efficiently absorbed.

The photographs show tests of a Salter duck as seen through the transparent sides of a wave channel. At the top, the orbital motion of the white particles suspended in the water, shown in a time exposure, reveals the existence of waves. The movement of the duck itself is blurred, but the absence of wave motion to the left proves that wave energy is being extracted. The high-speed photograph of a Salter duck in a breaking wave, bottom, was made to evaluate the duck's survivability.





Right:
The principle behind this 80-meter-long "Kaimei" ship, designed by the Japan Marine Science and Technology Center to harvest 2 megawatts of power in a typical North Pacific seaway, is simple: The ship contains 22 air-filled chambers open to the sea at the bottom but sealed with turbines at the top. As a wave passes the ship, rising water forces the air in each chamber to rush out through its turbine. As each wave subsides, valves permit the chambers to refill with air.

Far right:
The air bag device proposed by M. French of the University of Lancaster. Waves create an oscillating pressure inside rubber curtains that seal out the sea, and this pressure is transformed by a complex valve system into an air current that drives the turbine.

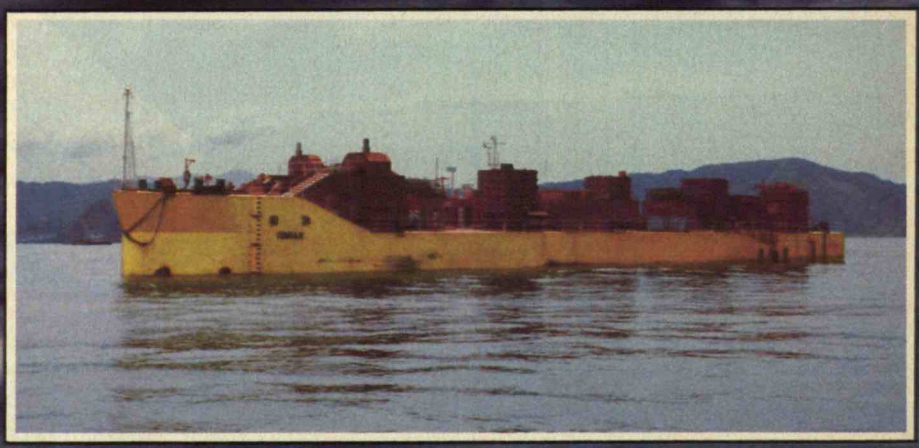
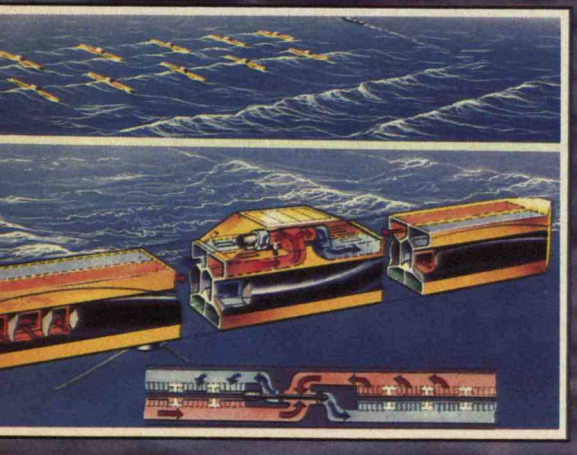


PHOTO: WALTER S. FROST, JR./THE PICTURE CUBE

form four functions. Obviously, as much of the waves' energy as possible must be converted to mechanical motion. Then a mechanism must convert this mechanical energy to a form such as electricity suitable for transmission and use. A transmission system is required, typically a cable passing from the device to the ocean floor and then to shore. Finally, power must be connected to a larger distribution grid. Also, the energy-extracting device must be moored in place and maintained for long periods in the hostile environment of the open sea.

Not all applications of wave power need be so elaborate. One of the most common simple ones is the use of wave power on a navigational buoy to sound a gong, bell, or whistle. This simple concept has been extended by the Japanese, who have replaced the gong or whistle with a small turbine to illuminate a signal light. Some 500 such wave-powered signal buoys have been used for 15 years in Japanese and other waters. The U.S. Coast Guard evaluated these as part of a broad study of its navigational buoy requirements some 10 years ago. However, the agency concluded that solar photovoltaic panels are a more suitable solution under the many different conditions of U.S. waters.

Larger-scale applications of wave power have been proposed that do not require connection to an electric power grid. For example, wave-powered desalination systems could provide water for island communities. Wave-generated power could also be used to make hydrogen and ammonia from seawater and to refine aluminum. And converting wave energy into hydraulic power for transmission ashore has also been suggested. Though these alternatives cannot be dismissed, electric power seems to be the most appropriate end product for exploiting wave energy.



Harvesting Wave Power

The most advanced large device for harvesting wave energy has been built by a group led by K. Masuda at the Japan Marine Science and Technology Center in Yokusuka, with support from the International Energy Agency and participation from the United States, Canada, Britain, and Ireland. This 80-meter-long "Kaimei" ship is in effect a laboratory to test a number of different pneumatic systems. All are chambers open to the sea below and sealed with turbines at the top, so that air is forced through the tur-

Continued on page 62

Continued from page 51

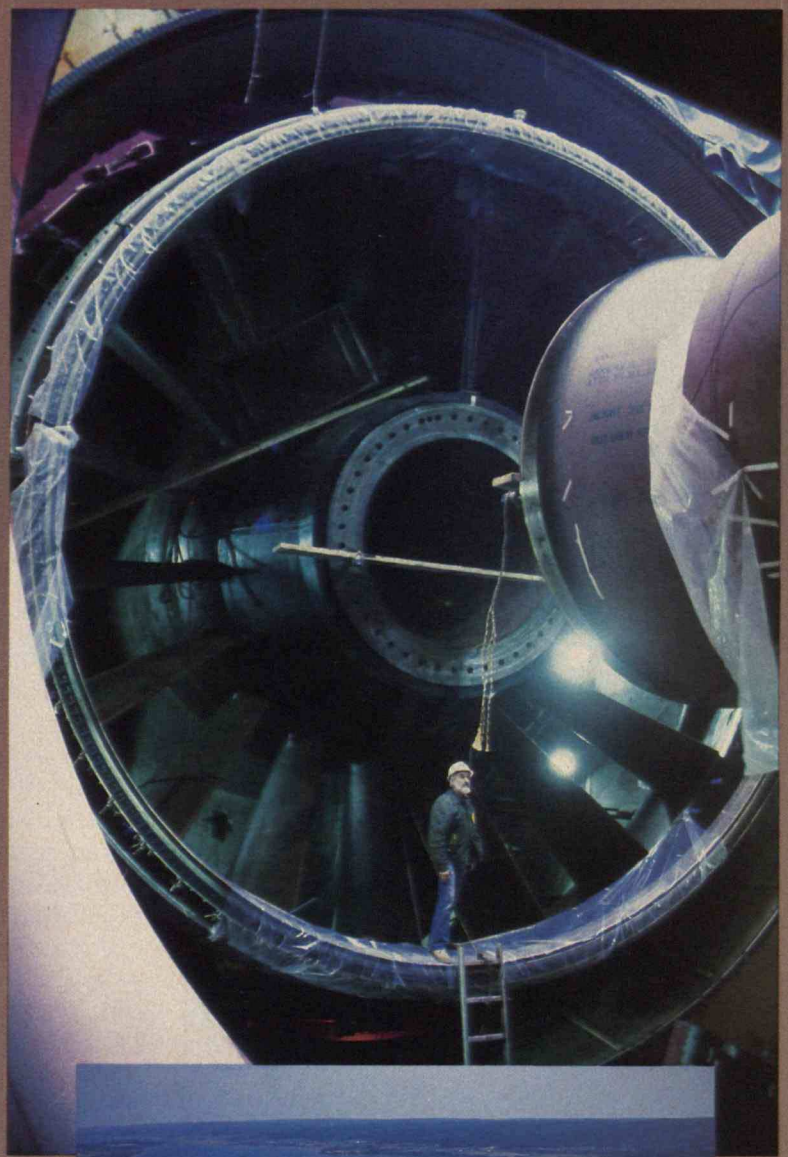
estuary in England, the Gulf of San Jose in Argentina, Bristol Bay in Alaska, and elsewhere in the Bay of Fundy in maritime Canada. The common denominator of all these proposals is their very large size—the plants would have the capacity to produce from 1,000 to 10,000 megawatts of electricity. (A large nuclear power plant can produce about 1,000 megawatts.) So far, none of these megaprojects has reached the construction stage.

There is no question that tidal power can be harnessed. Small tidal mills were built along the European Atlantic coast many centuries ago, and hundreds of tide-powered lumber and grist mills operated along the New England coast in colonial times. Indeed, the remnants of tidal dams are still evident today along the Maine coast. These mills typically generated at most 100 kilowatts of mechanical power from a water wheel or crude turbine made of wood and iron.

Two modern small tidal power plants are now operating. One across the mouth of the LaRance Estuary in northern France has run satisfactorily for 15 years, producing up to 240 megawatts of electric power, and a small 400-kilowatt demonstration plant at Kislaya Guba in Russia was built in 1967.

Following the Lunar Schedule

The simplest tidal-power system takes advantage of the fact that water levels rise and fall with the tides. A dam is built across the mouth of a cove to form a pond, which fills with water through a sluiceway as the tide comes in. At high tide the sluiceway is closed, and the pondwater returns to the



The only tide-operated electric generating plant in North America is nearing completion at Annapolis Royal on the Canadian side of the Bay of Fundy. An 18-megawatt generator, whose turbine is shown in the photograph, is being installed in a dam that was previously built across the Annapolis River to control storm surges. The aerial view shows impounded water escaping through the spillway at low tide. (Photos: Nova Scotia Tidal Power Corp.)

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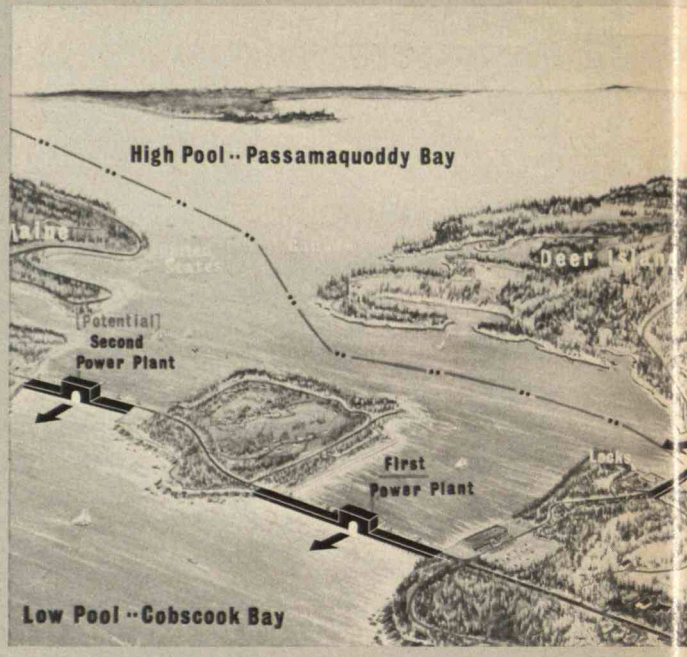
ocean at ebb tide through a turbine in which power is generated. As with hydropower, the cost of producing electricity from tidal plants is determined chiefly by the costs of the dam and the turbines; fuel costs nothing. And given well-designed turbines, a tidal power plant should have a long and reliable life.

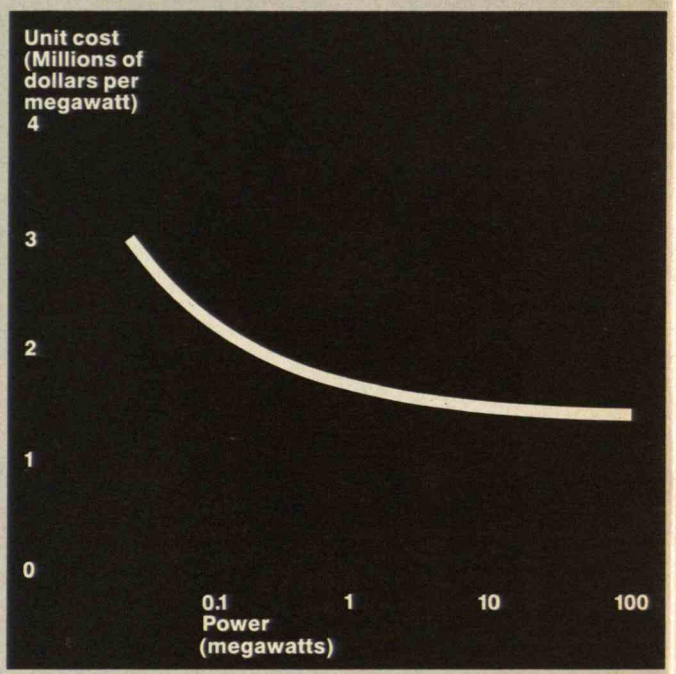
One disadvantage of tidal power is that it is intermittent—a conventional tidal plant produces power only a little more than half the time, when the level of water in the pond is higher than the level of the receding tide. Futhermore, the time of day that power can be generated varies because tidal motion follows the lunar day, which is about 25 hours long. Although early American settlers learned to run their mills on the lunar schedule, operators of a large tidal plant today would deal with this problem by tying the plant into an existing electric-power distribution network. Thus, when available, tidal power would displace that from fossil-fueled plants, conserving conventional fuels.

Several schemes can increase the time during which power can be produced from tides. Special turbines can generate power when they are turned in either direction, so that both incoming and outgoing tides can be harnessed. The pond, if large enough, can be subdivided into high and low levels so that the period of flow is extended. And tidal-generated electricity can be used to pump water into a higher storage lake, from which it can be released to generate power when needed. However, these schemes generally increase the cost of the electricity produced.

A major constraint on harnessing tidal power is that the difference in sea level between high and low tide—called the tidal range—is only about one meter in most of the world's oceans. However, the tidal range varies from three to six meters along the New England coast north of Cape Cod, the higher values being in eastern Maine near the entrance of the Bay of Fundy. In Minas Basin at the upper end of the Bay of Fundy, the tidal range reaches twelve meters.

The height of the tide has two effects on the efficiency of a tidal plant. First, the amount of seawater that can be stored in an enclosed tidal pond equals the surface area of the pond times the tidal range. Second, the amount of energy that each cubic foot of water generates as it flows through the turbine is proportional to how far the water drops—that is, the tidal range. Thus, the power available from a tidal pond is proportional to the square of the tidal range.

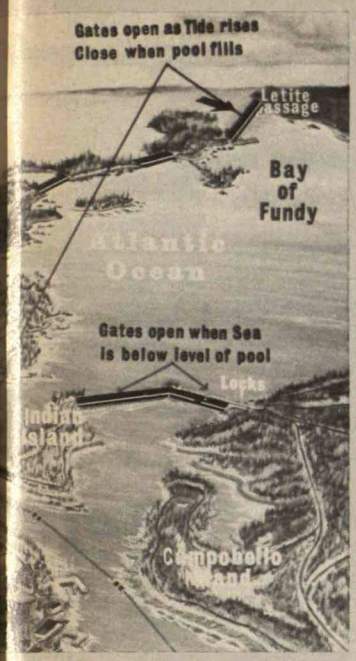




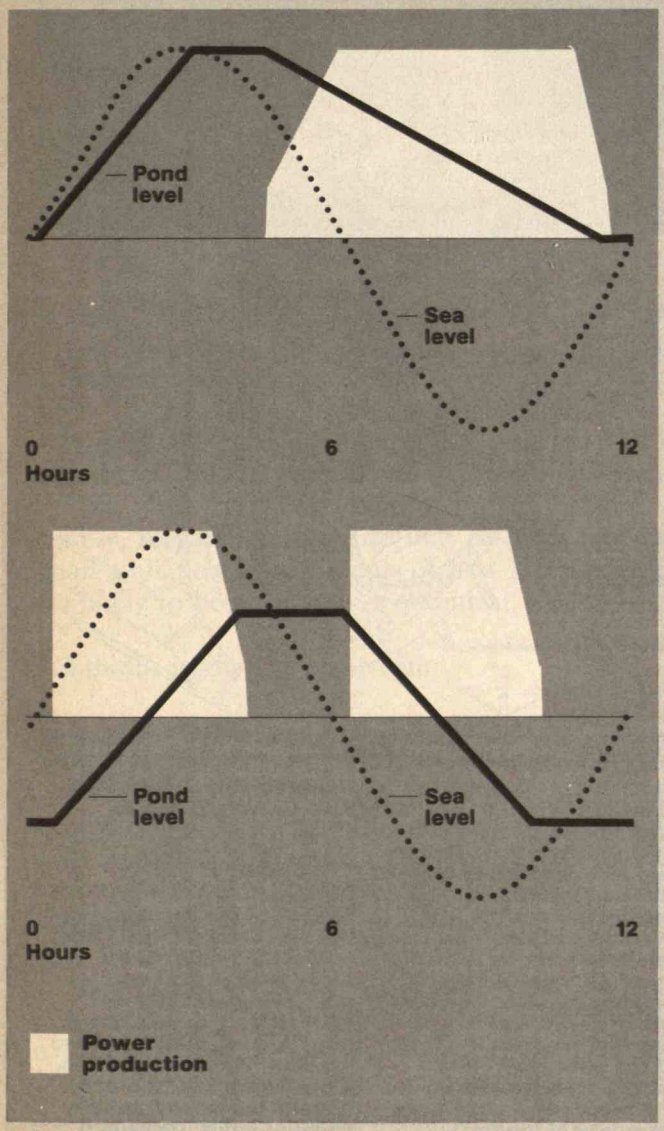
Above:
As tidal plants increase in size, the proportion of dam required, and hence the cost per unit of power, decreases. However, costs are reduced very little for plants producing more than 100 kilowatts of electricity. The costs shown are estimated for a typical site in eastern Maine.

Right:
The simplest tidal-power system operates on a single cycle (above): as the tide comes in, a pond fills through a sluiceway. At high tide the sluiceway is closed, and the pondwater turns a turbine as the water returns to the ocean. Thus, power is produced during a period only slightly longer than half the tidal cycle.

Power production can be increased by using turbines (below) that can generate power as the water both enters and leaves the pond. However, power production is still intermittent. Also, water levels during low and high tide are reduced, decreasing the mud flats that are host to so much marine life.



Left:
Large-scale exploitation of tidal power has never won support despite many plans. In this one, the high tides typical of the Bay of Fundy were to be utilized by making large areas of Passamaquoddy and Cobscook Bays into high and low pools for two major hydroelectric generating plants. As the tide rose, water from the Bay of Fundy (far right) would be admitted to Passamaquoddy Bay (top), from which it could flow only into Cobscook Bay (lower left) through turbines at the two power plants. The level of Cobscook Bay would be kept low by opening gates to the sea (at right) at low tide. (Photo: Bangor (Maine) Daily News)



This means that three-meter tides can generate nine times as much power as one-meter tides, for example. Furthermore, large and costly turbines are required to pass a large flow of water to generate useful power when the tidal range is small. For these reasons, sites with high tides such as the Bay of Fundy are preferred.

Environmental Changes

Canadian authorities are studying several sites where large tidal power plants could be constructed in the upper end of the Bay of Fundy. The most promising site, in Minas Basin, would require a plant of impressive dimensions. A five-mile dam would retain the pond, and more than 100 turbine generators would be installed to produce about 4,000 megawatts of electrical power. Power houses—the buildings that shelter the turbines—and sluice gates would be constructed on shore and floated into place. The economics of this plant are still uncertain, and the proposal has raised a number of problems typical of tidal-power systems.

Such a plant would bring permanent changes in the marine ecosystem. Because the tidal range in the upper end of the Bay of Fundy is so large, vast intertidal areas, mostly mud flats, are drained and reflooded during each cycle. Swift tidal currents also continually erode and redeposit bottom sediments. The rich variety of fish and bird populations that depend on these changes in the tidal flow and range could be adversely affected by the construction of a tidal dam.

But the most serious environmental effects of an upper Fundy tidal megaproject might extend far beyond the bay. David Greenberg of the Bedford Institute of Oceanography in Nova Scotia has shown that the Bay of Fundy is part of a tidal system that includes the whole Gulf of Maine—an area of water enclosed by Cape Cod and Nova Scotia and extending out across Georges Bank to the edge of the continental shelf. He believes that a barrier or dam across the bay would increase the tidal range throughout the Gulf of Maine by about one foot. This alteration would cause large-scale environmental changes affecting thousands of miles of coastline. These potential effects would be added to other issues such as acid rain, fisheries, offshore oil, and oil-refinery siting that already affect U.S.-Canadian relations.

Small May Be Beautiful

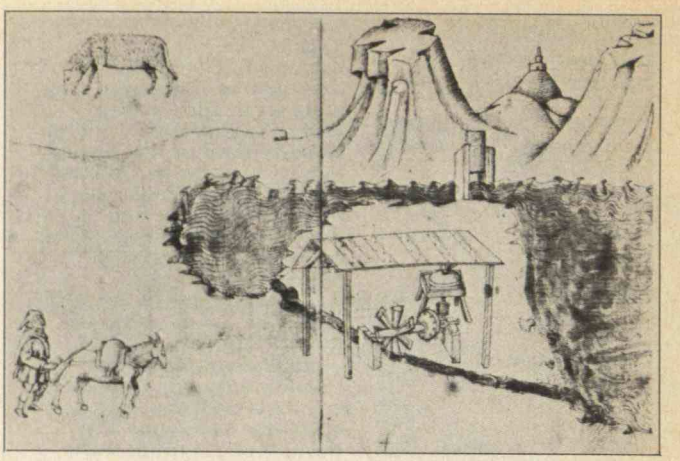
Harnessing the tides does not require constructing such large plants. In fact, small plants using small turbines have some significant advantages. For example, small increments can be easily added to such a system as the need for power grows. Sites that least interfere with other uses of coastal resources could be chosen from a large number of potential sites. And the environmental damage from smaller plants is likely to be reduced.

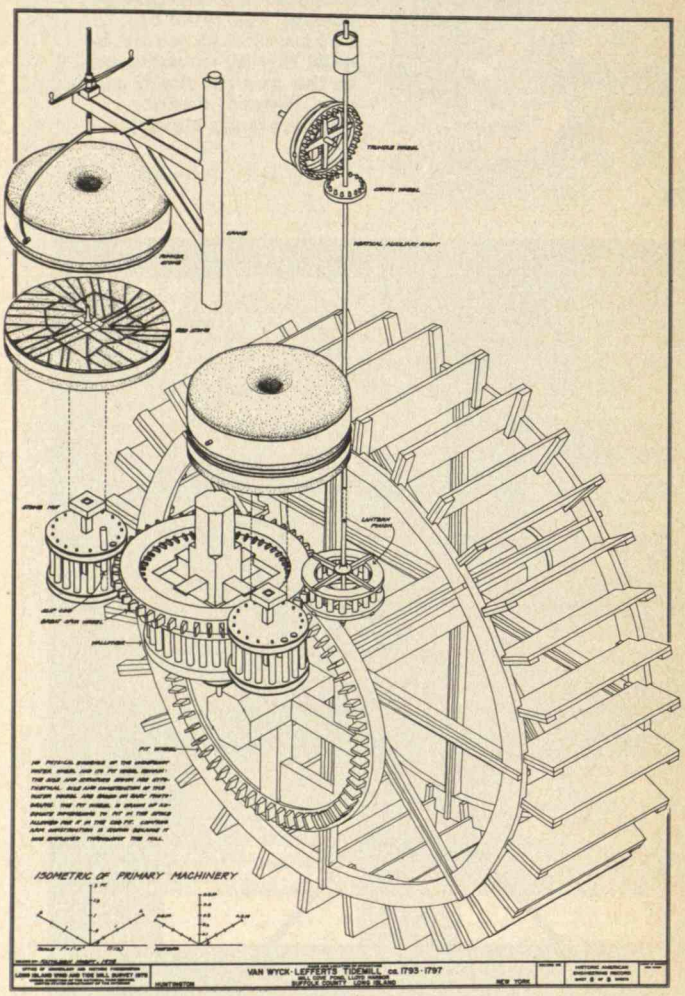
Unfortunately, environmental effects don't decrease as quickly as one might hope when projects are scaled down. For example, assume that two ponds are similar in shape but one has twice the length and width of the other. The smaller one has a perimeter one-half as long; hence the affected "intertidal zone" between high and low tides along the shore is one-half as great. But the small pond's surface is *one-quarter* that of the large one, and thus it generates only one-fourth the power.

The advantages of smaller-scale ponds motivated the decision in 1980 to build a small-scale tidal power plant at Annapolis Royal on the Nova Scotia side of the Bay of Fundy. An 18-megawatt turbogenerator is being installed at a dam across the Annapolis River previously built to prevent saltwater from surging onto fertile farmlands during storms. Most of the environmental effects of the tidal plant are already known, since the existing dam includes a sluiceway for regulating the flow of water in and out of the tidal river basin. The plant's builders—the Nova Scotia Tidal Power Corp.—expect to obtain valuable experience in constructing and operating a tidal plant.

Two tidal-power projects for Cobscook Bay in Maine have been studied recently. The Passamoquoddy Tribal Council has sponsored a preliminary design for one—a 12-megawatt plant estimated to cost $3 to $4 million per megawatt. This is comparable to the cost of building a nuclear power plant, if one accounts for the much shorter time required to build a small tidal plant. And the Corps of Engineers has investigated two sites for tidal plants that would generate up to 250 megawatts each.

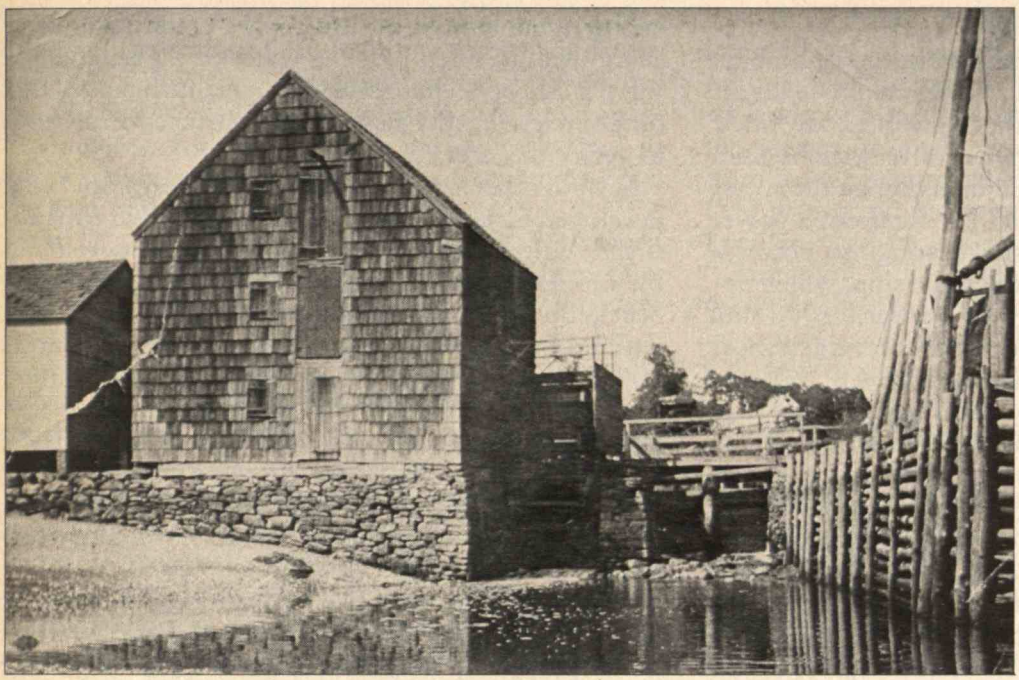
In projects of up to a few hundred megawatts, the cost of the dam is a major factor and increased size leads to increased economy. Consider two similar ponds, one twice as long and wide as the other. The larger one has four times the area—and hence generates four times the power—but requires a dam only





Top:
In his history of the vertical water wheel, Terry S. Reynolds describes this as the earliest existing illustration of a tide mill. The drawing is from the notebooks of the fourteenth-century Italian engineer Taccola. As the tide came in, the sluice gate at the top of the drawing was raised; when the tide was full the gate was closed and the water released through the mill race and water wheel (center). (Drawing: Stronger Than a Hundred Men, Johns Hopkins University Press, 1983)

Bottom:
Sketch of the machinery of the Van Wyck-Lefferts tidal mill, which operated in Lloyd Harbor off Long Island between 1793 and 1797. Water turned the large wheel, which ground grain between the stones, while the small "lantern pinion" drove an auxiliary vertical shaft. (Drawing: National Park Service)



This tidal-powered grist mill at Port Washington on Long Island was photographed around 1900. (Photo: Nassau County Museum)

twice as long. Thus, the larger project produces more power for a given amount of dam.

However, in larger projects the cost of the dam is likely to be a minor factor. Here the total cost is principally determined by the price of the turbine generators, the most expensive component. Except for the modest economies from production-line assembly, megaplants have no unit cost advantages—small-scale tidal power plants of 1 to 100 megawatts are likely to be at least as economical.

Windmills in the Ocean Stream

There is another alternative for harnessing power from tides, for the water's rise and fall is only one manifestation of tidal energy. Tidal currents that run strongly in and out of coves and bays, supplying and withdrawing large volumes of water, can be used to produce electricity. To tap this energy source while avoiding environmental problems, some inventors have proposed anchoring "windmills" underwater.

These small systems would not require dams and power houses. The "windmills" could be dispersed over a wide area—the equivalent of wind energy farms—and so interfere only slightly with tidal flow, navigation, and fish migration. The units could be located in water too deep to be dammed economically as well as in tidal streams and estuaries.

Using windmills underwater might not seem as economical as using them to produce power from wind, since tidal currents move more slowly than wind. However, the energy in a fluid is proportional to the fluid's density, and water is a thousand times denser than air. Thus, power in tidal currents is typically 10 times more concentrated than in wind. Also, for equal power outputs, a tidal turbine would be smaller than a wind turbine, and tides are far more predictable than wind.

Thus, the costs of tidal and wind turbines producing comparable power turn out to be approximately equal. The fact that wind turbines are economical in some locations makes the prospects for tidal-current turbines seem encouraging, and clearly such a system could be more compatible with the ecology and inhabitants' lifestyle of the lands fringing the Gulf of Maine than the huge projects using dams that are now contemplated. But the technology of these devices is not as mature as that of wind turbines or the turbogenerators used for more conventional concepts, and some skepticism is justified.

JAMES A. FAY is professor of mechanical engineering at M.I.T., where he specializes in environmental engineering.

Continued from page 55

bines as waves rise and fall. In some chambers "two-way" turbines are used to generate power as air flows in both directions. Other chambers are fitted with conventional turbines, with valve systems used to provide air flow in a single direction as the water level alternately rises and falls. The total rated power in a typical sea is 2 megawatts—enough to power a village of 2,000 homes. Although the ship, which operated during much of the time between 1978 and 1980, did deliver electrical power ashore, it fell short of its predicted output. Tests suggested that the 2-megawatt goal may be achieved after hydrodynamic details and turbines are refined.

In Norway, the "small is beautiful" concept has been applied to wave power by a group led by K. Budal and J. Falnes at the Norwegian Technical University in Trondheim. Their idea is that a large array of small, mass-produced wave-energy absorbers can be more rapidly and cheaply deployed and maintained than large structures. This concept has been tested extensively in laboratory wave tanks, and an intermediate-scale model is on trial in Trondheimsfjord.

One problem with such small floating devices is that they may bob up too soon after a wave passes, thus opposing rather than enhancing the motion of the next wave. The ideal is to have the waves and the collecting device bobbing at the same frequency so that the movement of the device is maximized, just as a child can bounce resonantly in a rowboat and so increase its vertical movement. The Budal-Falnes system overcomes this tuning problem with a latch system, in which a brake alternately restrains and releases the float at optimal times in each cycle of its motion. Substantial power can be absorbed by relatively small buoys using this system: a pneumatic system in a 120-ton floating buoy can be rated at 300 kilowatts. Arrays of these devices are expected to give high overall efficiency.

Another approach to harnessing wave power is advocated by a group led by E. Mehlum at the Central Institute for Industrial Research in Oslo. This group has designed a "wave lens" to concentrate wave energy so that it can be more readily converted to mechanical energy. The lens consists of a submerged cylinder that causes the waves passing the cylinder to lag differentially, changing their direction so that they meet at a focal point. Thus, the waves' energy is concentrated just as an optical lens concentrates light energy. One way to exploit such a concentration of energy would be to pass the water of the heightened wave crests up a chute and through a turbine. A large outdoor test facility has been constructed near Olso to verify this concept.

Several other ways to collect wave energy are being developed in Great Britain. The best known of these is the "Salter duck," a cam-shaped vessel developed by S.H. Salter at the University of Edinburgh. When oriented so that its teardrop-like "beak" is parallel with and facing the oncoming waves, the beak nods up and down with the waves. By carefully designing the cam's cross-section and moment of inertia, engineers can make it resonate with the frequency of the arriving waves so that their energy is efficiently absorbed. But extracting power from such a system is a problem, since there is no fixed frame of reference to oppose the "nodding" motion.

One suggestion is to use two gyroscopes spinning about the vertical axis in opposite directions. They move perpendicularly to the duck's nodding—one going one way and the other the other, somewhat like doors opening in opposite directions. This motion produces mechanical energy. The technology is complex and its reliability at sea questionable, but tests in a narrow wave tank in Edinburgh showed that 80 to 90 percent of the available wave energy was absorbed. Later an intermediate-scale experiment was successfully performed with a string of ducks in Loch Ness. Wave-power advocates continue to debate the relative merits of this approach.

Another sophisticated British energy-collection device is the submerged "Bristol cylinder." This is an array of air-filled vessels moored just beneath the surface so that each moves up and down as waves pass. The energy in this up-and-down movement is captured by a piston moving in a cylinder attached to the anchor. The rising and falling of the piston as the vessel rides the waves generates fluid pressure in the cylinder, and high-pressure hydraulic lines bring the energy to shore. Experiments have confirmed that this system is theoretically very efficient, but designing mooring arrangements and extracting power is difficult.

Another long-term British project is the "oscillating water column" developed by the National Engineering Laboratory in Scotland. The column is a large, vertical, air-filled chamber open to the water below but sealed with a turbine at the top. As waves pass, they alternately increase and decrease the air pres-

	Average annual wave height (meters)		Average wave period (seconds)		Average power (kilowatts) per meter of wave front	
	Coastal	Deep ocean	Coastal	Deep ocean	Coastal	Deep ocean
North Atlantic	1.0	3.2	8.5	6.3	5.2	37.1
Mid-Atlantic	0.8	2.7	7.9	5.9	3.1	25.6
South Atlantic	0.7	2.4	6.7	6.0	2.4	22.1
North Pacific	NA	3.4	NA	11.0	NA	81
Mid-Pacific	1.0	2.6	10.4	10.3	5.7	52
South Pacific	0.9	2.1	13.2	13.2	4.9	25

Waves contain large amounts of energy. This table shows the power available from waves of different sizes and frequencies averaged over an entire year. The figures for power per meter of wave front are based on use of a "Salter duck."

sure, pushing and drawing air through the orifice that contains the turbine. Pneumatic devices such as this and the Kaimei are attractive because they do not require heavy, oscillating elements typical of mechanical devices. Air can be more easily constricted to obtain the relatively high velocities required to operate a turbine efficiently.

Other similar semisubmerged devices have been designed in Britain to operate, like the Kaimei ship, with their long dimensions perpendicular to the wave crests. Properly designed, such devices can absorb wave energy from a broad wave front, just as a radio antenna intercepts radio waves from a wave front much larger than its diameter. In the "air bag," originally advocated by M. French at the University of Lancaster, flexible rubber diaphragms and constrictions concentrate the movement of air inside the bag as waves traverse its length, with the air flow used to drive conventional turbines. Engineers estimate that a relatively narrow device with an overall length of as much as 250 meters could absorb energy over a width as great as half a wavelength.

Interest in wave power in the United States has been limited and vascillating at best. As a joint participant in the original Kaimei development, the Department of Energy sponsored the design and construction of a special turbine to be installed in one of the Kaimei chambers, but delays prevented this plan from being consummated. The only other substantial U.S. project on wave energy is being conducted by Lockheed, which is designing a device known as the "Dam-Atoll." This concept calls for a large submerged, spherical vessel that will bend waves toward its vertical axis, where the concentrated water flow will pass through a turbine.

The Future of Wave Power

As with most other unconventional sources of energy, the economic prospects for wave power are too uncertain to stimulate long-range planning and investment. The cost of electricity produced from large-scale wave-power systems in optimal locations—including the cost of collecting devices, mooring, transmission, and maintenance, with capital bor-

Continued on page 69

Wave Power for New England

How much might wave-generated electricity cost in New England? To answer that question, in 1978 A. Douglas Carmichael of the M.I.T. Department of Ocean Engineering analyzed a single small "Salter-duck" system moored offshore with an internal energy-conversion device and an electrical cable to shore.

He evaluated two New England sites—3 kilometers off Nauset Beach on Cape Cod, and 200 kilometers off the Massachusetts coast. He estimated that the costs of building the electric transmission system from converter to shore to be $40,000 per kilometer, independent of the amount of power to be carried by the cable.

The predicted capital cost for the the near-shore device was just under $13,000 per kilowatt; that for the ocean site was $10,667 per kilowatt. The near-shore system turns out to be more expensive overall for two reasons: the average available wave energy near shore is lower and the waves are long, so the Salter cam must be large. The offshore system is much more expensive to build—costing $2.1 million compared to $3.6 million—but it is more efficient and taps a much larger energy source.

Moorings alone account for almost two-thirds of the cost of the near-shore device, with structural costs almost 25 percent of the total. The major cost of the open-ocean system is for the transmission cable. However, because available wave power is much greater, the offshore location provides more power per unit of capital cost.

The cost breakdown resulting from the study reflects two basic unsolved problems of all wave-energy devices:

☐ To obtain high power density and hence efficient mechanical wave-energy conversion, one must move away from the coast. Bringing power ashore then becomes a formidable problem. The cost of transmission cable was assumed to be about $40,000 per kilometer. If that cost is independent of power capacity, a system using five cams with a single transmission cable extending 200 miles off the coast would cost only $4,300 per kilowatt. As the distance offshore increases, of course, the cost of bringing power ashore becomes greater, so there is a trade-off with systems in near-shore locations that offer less power.

☐ The cost of mooring a converter is much larger than the cost of building one. If a more efficient way could be found to support the Salter cam and prevent heaving and pitching, the cost of the mechanical system could be reduced by half to two-thirds.—*John Mattill* ☐

Genetic Research, Scientists as People, and Einstein

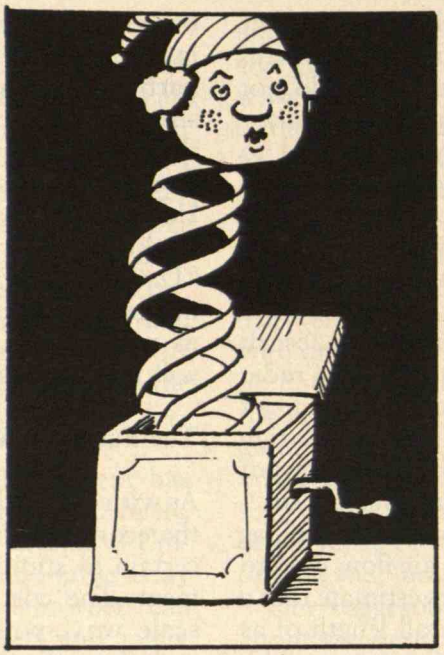
Hazards of Genetic Research

Genetic Alchemy: The Social History of the Recombinant DNA Controversy
by Sheldon Krimsky
M.I.T. Press, 1982

Reviewed by Jonathan Beckwith

In the early 1970s, an extraordinary episode in the history of contemporary science began to unfold. In a letter published in *Science* magazine, biologist Maxine Singer and Dieter Soll expressed "deep concern" over the possible "hazardous" nature of certain hybrid DNA molecules. In 1974, James Watson and several other molecular biologists called for a moratorium in certain areas of recombinant-DNA research. These early warnings had great consequences. Within four years, public controversy had led to guidelines on recombinant-DNA research from the National Institutes of Health (NIH), public hearings in a number of cities, and the prospect of federal legislation to regulate scientists in their laboratories.

These unforeseen results of publicly airing the possible health hazards of recombinant-DNA research led many of the original supporters of the moratorium to regret their decision. An angry James Watson suggested that the discussion had turned into a "surrealistic nightmare" and was a "massive miscalculation in which we have cried wolf." Maxine Singer argued that public involvement had gone too far and that science must live by "elitist criteria." Today NIH guidelines have been reduced to a minimum, most scientists feel genetic research is safe, and science reporters focus almost entirely on the potential benefits to society and new business opportunities in biotechnology.



How, in the space of a few short years, did the concerns of scientists over health hazards shift so dramatically? Was the shift justified? Sheldon Krimsky deals with these questions in *Genetic Alchemy: The Social History of the Recombinant DNA Controversy*. The book reads in its early chapters like a gripping historical novel. Just as Horace Judson turned the history of molecular biology into an exciting intellectual adventure in *The Eighth Day of Creation*, Krimsky reconstructs the many social and scientific threads that converged in this controversy. He comes well-prepared to the task: he was trained as a philosopher of science and was directly involved in the controversy as a member of the NIH Recombinant DNA Advisory Committee and the City of Cambridge (Mass.) Experimental Review Board, which evaluated the research.

Potential Pathogens

Krimsky is more skeptical than many authors of the reassurances by leading scientists that the hazards of recombinant-DNA research are minimal. To justify this skepticism, he presents a wealth of detail from his own experience and a comprehensive collection of documents, including taped interviews with those who played significant roles in the debate.

As Krimsky describes, the researchers were greatly influenced by the political activism of the sixties. Many critics of recombinant-DNA work were members of Science for the People, a group with a radical critique of science founded in 1969. Other scientists such as David Baltimore were particularly affected by the 1969 work stoppage by scientists and students at M.I.T. protesting university involvement in the Vietnam War.

Concerns over recombinant-DNA research focused on several issues. First, the organism into which most genes were being introduced was the bacterium *Escherichia coli*, a common inhabitant of the human gut. Scientists were concerned that they might inadvertently convert the laboratory strain of *E. coli*, called K12, into a human pathogen by introducing new genes. And a number of researchers were worried that harmful ecological consequences might result from constructing organisms that had never been created in nature. Some felt they were breaching a natural barrier against the exchange of genetic material between species.

Risk-assessment experiments were conducted to test the likelihood of the various scenarios. Although limited, these tests led to a dramatic shift in opinion among scientists about the dangers of recombinant-DNA research. By 1978, many of the concerns about health hazards had disappeared, and by 1980, most of the few remaining questions had been answered to nearly everyone's satisfaction. In fact, I was one of those who became convinced at this point that most of the suggested dangers were highly unlikely.

Yet, as Krimsky points out, this shift in attitudes does not seem to be warranted by the meager and often contradictory evidence. Depending on how they were viewed, the risk-assessment experiments could support the conclusion that either K12 was a potential pathogen or that it was the ideal organism for recombinant-DNA research. Therefore, Krimsky proposes that scientists' rapid acceptance of the safety of most recombinant-DNA research was more of a political attempt "to regain control over their working conditions." Scientists seemed more prepared to

BOOKS REVIEWED THIS ISSUE

Genetic Alchemy: The Social History of the Recombinant DNA Controversy
Reviewed by Jonathan Beckwith

Scientific Temperaments: Three Lives in Contemporary Science
Reviewed by Lynn Hall

'Subtle Is the Lord . . .': The Science and the Life of Albert Einstein
Reviewed by Steven J. Heims

accept arguments that their work was safe than arguments that it was not, and some even were willing to exaggerate the significance of scientific evidence.

For example, in 1977 Stanley Cohen, a Stanford biologist, attempted to blunt efforts to pass federal legislation regulating biotechnology. He distributed copies of an unpublished manuscript in which he showed, on the basis of little evidence, that DNA is exchanged between species in nature. Despite the flimsiness of the data, this preprint played a key role in reducing legislators' interest in regulating the research.

Public Oversight

Yet Krimsky is missing something in this analysis. Although he accurately describes the social components of the shift in scientists' attitudes, he does not delve into some of the more subtle advances in scientific knowledge that also helped change scientists' opinions on the safety of the research. These advances were especially important since even one of the strongest critics of recombinant-DNA research, M.I.T. biologist Jonathan King, called the epidemic-pathogen scenario a "strawman."

For example, although scientists originally thought that they might create a pathogen by introducing certain genes into K12, they found that multiple factors are necessary for bacteria to infect humans. Similarly, researchers discovered that introducing DNA from one organism into another was simpler than they had imagined. Today the idea that DNA is exchanged between species in nature is so respectable that some biologists use it to help explain evolution.

While these advances in scientific knowledge were occurring, the involvement of the public in the controversy was growing. As an example, Krimsky gives an inside view of the workings of the Cambridge Experimental Review Board (CERB). This predominantly lay group issued a document that may well become a model for future citizen involvement in scientific questions. While the board gave the green light for recombinant-DNA work to proceed in Cambridge, it went beyond the NIH guidelines in elaborating additional steps to monitor the research. The board also alluded to longer-range concerns, stating that "the social and ethical implications of genetic research must receive the widest possible dialogue in our society."

However, scientists today differ in their opinions on the wisdom of involving the public in these issues. Some, convinced that the scientific community was burnt by the recombinant-DNA controversy, feel that such problems are best resolved by scientists themselves. Others, while concerned about what they see as public overreaction, still believe in public involvement. If one agrees, as I do, with the CERB statement that "knowledge, whether for its own sake or for its potential benefits to humankind, cannot serve as a justification for introducing risks to the public unless an informed citizenry is willing to accept those risks," then a mechanism must be found for such public participation. As the CERB proved, when a citizen's group is given an opportunity to pursue scientific issues in depth, rational and satisfactory solutions emerge.

The need for early and direct public involvement in overseeing scientific research is particularly pressing today in the field of biotechnology, which appears to be entering an era of human genetic engineering. Representatives of community groups could sit on institutional review boards that regulate such research. These boards could also probe more deeply into related ethical and social questions. Thus, community representatives could become knowledgeable enough to point out to scientists where problems might arise or reassure the public on specific issues.

According to Krimsky, the issues raised by the recombinant-DNA controversy indicate that the biological sciences are passing from "their age of innocence to their age of anxiety." In *Genetic Alchemy*, he has given us new insights into how this passage is taking place. □

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ILLUSTRATIONS: MARJORY WUNSCH

The Human Side of Science

Scientific Temperaments: Three Lives in Contemporary Science
by Philip J. Hilts
Simon and Schuster, 1982

Reviewed by Lynn Hall

In *Scientific Temperaments*, Philip J. Hilts, a writer for the *Washington Post*, profiles three prominent scientists: physicist Robert Wilson, a protege of Robert Oppenheimer and the builder of Fermilab; Harvard molecular biologist Mark Ptashne; and Stanford computer scientist John McCarthy. The author tries to show scientists as people, portraying the frequently ignored link between the science and the scientist. He writes: "Science is not the dispassionate analysis of impartial data. It is the human, and therefore passionate, exercise of skill and sense on such data. Science is not an exercise in objectivity but, more accurately, an exercise in which objectivity is prized."

Hilts understands how scientists *feel* about their work, capturing the side they usually keep hidden beneath professionally cool exteriors. He writes of Wilson: "Leaving the laboratory after a night's work, he watches the world stir with the sun and go to work, passing him in the opposite direction. He feels himself singular, gliding against the current, and it is exhilarating."

He also understands how physicists think: "In public, physicists speak in formalisms that are careful and limited. But privately, physicists grapple with the particles in just the way the rest of us do. They try to picture them, they try to imagine them as things acting in thing-filled terrains. . . . Asking a physicist to disclose his own private way of imagining particles is, perhaps, like asking a theologian to disclose his own private way of imagining God. . . . When a physicist is asked for his personal view of the unimaginable, he is understandably reluctant, perhaps a little embarrassed. He would not like his colleagues to hear him talking about little flying balls."

Hilts has grasped something that people don't usually understand about physics and physicists. When one deals with concepts that transcend human experience

and perception, the brain keeps trying to force the ideas into a familiar framework. For me, studying quantum mechanics had a wrestling-with-fog aspect—the equations make perfect mathematical sense, but when you start trying to visualize what's happening, the ideas keep slipping away. The embarrassment comes from knowing perfectly well that those little balls exist only in one's mind.

Scientific Stereotypes

I agree with Hilts that "we take scientists too seriously. We forget they are people of ordinary habits and passions and that this is one of the most important facts necessary to an understanding of science." However, this point is the source of my one major complaint about the book: each of these scientists embodies an aspect of the scientific stereotype and thus contradicts Hilts' own thesis that scientists are ordinary people. Not only are the "habits and passions" of these men not ordinary, they are unusual to the point of eccentricity and obsession.

Wilson is deliberately irascible. He growls at subordinates and buries his office phone in a potted palm to stop its annoying ring. In his youth he was withdrawn (his wife says half-jokingly that he began to talk at 28) and a positively maniacal researcher. He once ignored his body's warning signals and continued to work until he collapsed with a ruptured appendix.

Ptashne is the archetypal Big Scientist, a brash, ambitious, confident go-getter who doesn't suffer fools gladly—he "enjoyed the game of dipping the ideas of others into acid"—and whose "predominant mode of communication . . . is argument."

McCarthy is a hyperrational, somewhat out-of-touch dreamer, a classic computer hacker. "When he entered the office the first time I met him, his greeting consisted of an expectant stare. No words at all."

Hilts undoubtedly chose to profile these three scientists because they are at the top of their fields, and because their personalities are lively and colorful enough to provide excellent examples of what Hilts calls "the combustive chemistry of ideas and temperaments mixed." But these men bear the same relationship to the average working scientist that Glenn Gould did to the average pianist, and that Norman Mailer does to the average novelist. Hilts simply reinforces the public's sterotyped image of scientists by presenting these three, even implicitly, as in any way typical.

Hilts carries these stereotypes one step further when he says of Ptashne that his "unusual personal habits and ways of thought have been essential to his work in science. . . . Though for many scientists the habit is not carried out so elaborately in their personal lives, it seems that contrariness is crucial to critical, creative thinking. What is accepted as true might be wrong; what is impossible might be tried."

But one might just as easily argue, and be as nearly correct, that scientists are conservative traditionalists because their inherent skepticism demands that the superiority of a new idea be demonstrated thoroughly before they accept it. Hilts also seems to think that Ptashne's rough-edged personality is a necessary adjunct to his scientific talents. But all too often creativity is used to excuse behavior that is insensitive or merely rude. If scientists are, after all, "ordinary people," their vocation shouldn't justify antisocial behavior.

Scientists have their own stereotypes of

what scientists are like, and this affects their dealings with journalists. For example, Hilts says that "like many scientists, Ptashne distrusts journalists. . . . He has refused many requests for interviews, and many people have told him he is foolish for allowing himself to be a subject in this book. First, it is thought immodest among scientists to speak publicly of personal matters. Publicity is counted as an evil, sometimes necessary or even useful, but always dishonorable. Ptashne [also] said that any personalized account must necessarily distort the role played by others in the science, which spreads ill will."

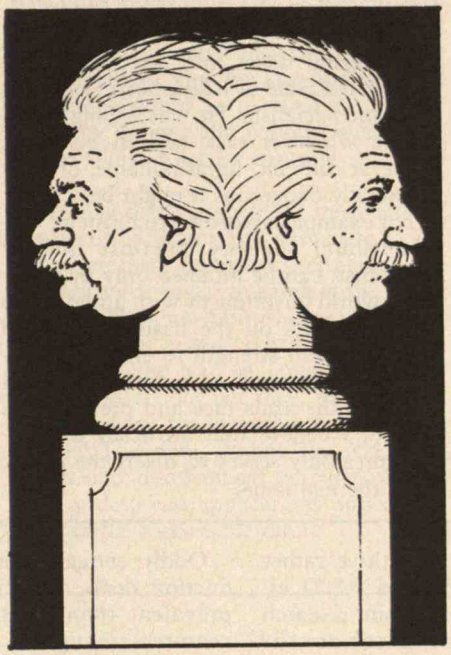
But I suspect that many scientists shun person-oriented stories not only out of modesty but because such accounts tend to contradict the notion that scientific research is a logical, objective process. Pinning a discussion of a scientific topic to a real scientist can make science, and the scientist, look all too human.

Hilts himself recognizes the limitations of non-science-trained journalists who deal with scientists. For example, he writes that "journalists began to appear in the laboratories of artificial intelligence. They came with the usual baggage that journalists haul about with them—bright, curious intellects completely unmarred by knowledge, and dark, skeptical frowns that hide gullets big enough to swallow anything."

Hilts works carefully within his chosen format—the profile—to avoid these problems. He deals with the science clearly and confidently, using it primarily to illuminate the life and work of the scientist. And although the person being profiled must take center stage, Hilts frequently mentions the contributions of coworkers, students, and competitors. He also lets these people, as well as family and friends, speak (sometimes pungently) about the scientist.

Thus, *Scientific Temperaments* is elegantly and gracefully written, colorful without being flashy, and precise without resorting to jargon. The progression of ideas, and the way in which biographical materials are interwoven with scientific information, is so natural that the style always serves the material. □

Lynn Hall is a doctoral candidate in geophysics at M.I.T. She was a 1981 AAAS Mass Media Science Fellow at Newsweek.



Einstein: Classicist or Revolutionary?

'Subtle Is the Lord . . .': The Science and the Life of Albert Einstein
by Abraham Pais
Oxford University Press, 1982, $25

Reviewed by Steven J. Heims

Writing a fresh and fascinating biography of Einstein when at least seven competent biographies already exist is difficult. But *'Subtle Is the Lord . . .'* by Abraham Pais, a theoretical physicist who became friends with Einstein during his last decade, is such an achievement. Whereas earlier biographies sought to popularize Einstein's ideas for lay readers, Pais presents the technical details of Einstein's work for those with a knowledge of physics.

By drawing heavily on archival material, much of which became accessible only during the last few years, Pais convincingly reconstructs much of Einstein's step-by-step thinking as he developed his major theories. Pais' description of the false moves, the roles of collaborators and competitors, and the progression from profound and simple physical ideas to complex mathematical formulations helps to demystify Einstein's scientific thinking. Pais also shows him to be like ordinary people in some respects. For example, another historian has suggested that Einstein scarcely paid attention to the British eclipse expedition in 1919 to test his General Theory of Relativity, and was "quite unmoved" when the favorable results came in. But Pais says that despite his deep confidence in the theory, Einstein was excited by the expedition's good news.

Pais also differs significantly from other scholars in downplaying the rebel in Einstein. As he makes the details of Einstein's work comprehensible, Pais goes one step further and assimilates Einstein into the mainstream of the physics profession. Pais asserts that "in his personal and scientific conduct [Einstein] was not a rebel, one who resists authority," but merely free and independent. For example, Pais emphasizes the idea that relativity theory was a fulfillment of classical physics. But he seems to forget that it was also an overthrow of important nineteenth-century beliefs.

According to Pais, Einstein "was so free that any form of authority but the one of reason seemed irresistably funny to him." However, to present the full picture, Pais would have to do justice to the Einstein who wrote to Sigmund Freud of a "contempt for authority"; who deeply resented institutional pressures on scientists, especially as these pressures tended to "seduce scientists into superficiality"; who recommended that the young practice science as an avocation rather than as a means of earning a living; and who, at the height of the Cold War, advocated that scientists engage in Ghandi's method of noncooperation and civil disobedience to prevent a nuclear arms race.

In his habitual willingness to go to the root of issues, Einstein can only be characterized as intellectually radical. For example, no one questions the fact that Einstein's 1905 light-quantum hypothesis—in which he said that light was composed of discrete units, photons—was revolutionary. But Einstein also believed that quantum theory, which stemmed from that hypothesis, provides only an "incomplete" description of physical reality, even though it was verified by a host of experiments. To him the mere success of a theory—its agreement with experiment—did not prove its correctness. After all, however successful Newton's theories of mechanics and gravitation, they were totally reformulated according to the principles of relativity. Einstein

UPCOMING IN OUR AUG./SEPT. ISSUE

Hydro: Think Small
New technology, new incentives, and the New England tradition of independence are spawning new sources of electricity.

Davy Jones' Dump
Management, not protection, is the growing trend for waste disposal in the ocean.

The Computer Industry in Crisis
Why Japan is poised to compete in advanced microelectronics, while the U.S. is not—and how to catch up.

Bursting the High-Tech Bubble
High technology will not lessen unemployment or upgrade workers' skills, and may even make jobs more routine and boring.

Telephones on the Move
Cellular-radio technology is ready to meet the growing need for mobile telephone service in the U.S. and in the world.

BOOKS

Continued from page 67

challenged physicists not to be satisfied with the "gentle pillow" of quantum theory but to formulate a more complete description of atoms and electrons as part of a "unified-field" theory, which is still being sought today.

Einstein carried the habit of addressing fundamental issues into his political beliefs on the State of Israel, Nazi Germany, war, and socialism. He was willing to advocate whatever task had to be done, however difficult, unfashionable, or even personally dangerous it might be.

For example, according to Einstein, "international security (against nuclear holocaust) can be attained only by creating a world government with authority to settle conflicts on the basis of law and with sufficient strength to enforce its decisions. No less radical a measure will call a halt to the arms race and prevent war. Indeed, I believe that advocacy of half-measures only serves to divert the public from the real issue.

"Representatives to supranational organizations . . . must be elected in each member country *by the people* themselves through a secret ballot. The elected representatives will hence represent the people and *no longer the various governments*." He further urged that conscientious noncooperation in the face of a weapons-minded national government be protected by law, according to the principles established during the Nuremberg trials of German war criminals.

Although *'Subtle Is the Lord'* gives a full tour through Einstein's scientific works, the book, along with the recently opened Princeton Einstein Collection of primary source material, will undoubtedly only stimulate historians to further study. □

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ANTITRUST

Continued from p. 49

plaintiffs would be required to demonstrate that a particular joint venture actually would result in restraint of trade. Moreover, private parties would be limited to single-damage claims.

While each of these measures takes a different approach, all are intended to lessen the chances of antitrust challenges and eliminate the threat of severe penalties in cases of flagrant anticompetitive behavior. As Inman said at the party on Capitol Hill, the common intent is to switch the statutory signal from amber to green.

Neither the House Judiciary Committee nor its Senate counterpart has rushed into early consideration of these bills because of other pressing matters and unresolved questions about broader antitrust policies. Thus, critics of antitrust waivers, who have been quiet thus far, will have time to muster their arguments.

One of the strongest arguments against the easing of antitrust restrictions is that the nation may be better served by competitive rather than coordinated R&D efforts. Critics of joint research efforts may point to the Clinch River breeder reactor, the British-French Concorde, and assorted synthetic-fuel projects as examples of technological or economic lemons that arose from committees rather than lone innovators.

Flagging Joint Production

Furthermore, some antitrust specialists don't believe that a successful suit against joint research ventures could be brought under existing laws. They note that such laws do not apply literally to joint R&D but rather to production and marketing behavior. Justice Department guidelines, for instance, cite as a potential red flag any agreement among sponsors to withhold new products they may have developed independently but that might compete with their joint research results. Any agreement to jointly exploit the fruits of their research would be another potential cause for objection. Thus, the department's guidelines generally focus on the marketplace, not the laboratory.

Oddly enough, joint production deals are far more prevalent than joint R&D ventures among U.S. firms. Oil companies, for example, commonly engage in joint leasing and production arrangements. Automobile companies have engaged in various international ventures—the latest being the agreement between General Motors Corp. and Toyota Motor Corp., companies that rank first and third in worldwide auto production, to coproduce subcompact cars at an idle GM plant in California. The GM-Toyota pact, currently under review by the Federal Trade Commission, appears to offer a fatter target than a high-tech R&D effort. As Gerald Greenwald, vice-chairman of Chrysler Corp., asked a congressional subcomittee, "What were the antitrust laws intended for if not to prevent a linkage of two companies of this magnitude?" Chrysler has since filed formal objections to the merger with the FTC.

Meanwhile, few joint R&D ventures have materialized among American firms. The Electric Power Research Institute and the Gas Research Institute do conduct studies for sponsoring utility firms—but utilities are classed as regulated monopolies rather than market competitors. The only current joint U.S. R&D venture comparable to MCC appears to be the Semiconductor Research Corp., another new entry in the electronics field, which was set up last year by some 15 semiconductor makers to develop advanced chips. Their central research facilities are located at Research Triangle Park in North Carolina, which may also become the headquarters for MCC.

Whether such joint R&D ventures will prove effective remains to be seen. The concept certainly runs counter to imbedded notions about the free-enterprise system and the virtues of rugged corporate individualism and entrepreneurship. But at this juncture, Congress seems inclined to give its blessing to Inman's MCC and other joint R&D ventures that may follow. □

Continued from page 63

rowed at 10 percent amortized over 20 to 30 years—is placed by British consultants at 10 to 20 cents per kilowatt-hour. This compares unfavorably with the current cost to produce electricity in Britain and the United States—about 5 cents per kilowatt-hour. Engineers in the wave-power field tend to be more optimistic about the ultimate performance and costs of wave-power devices, but many more designs and tests will be required to justify this modest optimism.

Studies continue on harnessing wave power at special sites where this technology could be economical. These sites are typically island communities such as the Hebrides, Shetlands, and Faeroes where the waves are energetic and conventional electrical generation is costly. Preliminary designs from the British wave-energy program suggest that a variety of systems with capacities of one or two megawatts are possible for such sites. The simplest structures would be pneumatic devices—columns of water and air with turbine generators at the top—attached to the ocean bottom close to shore. Fifty such structures along only 100 meters of coast would generate significant amounts of power, with minimal mooring and transmission costs. But backup fossil-fueled generators would be required to produce electricity during calm periods, unless customers did not need a constant supply of power.

In Great Britain, where the most activity has occurred during the past eight years, the government decided to terminate support for wave-power research in the spring of 1982. Thus, most British research in this area has now ended. Japan and Norway could take the lead in large-scale wave-energy conversion, but they, too, seem to be guided by the negative British projections. Therefore, despite the recent research and development activities in this field, widespread applications appear unlikely in the foreseeable future.

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The New Ceramics

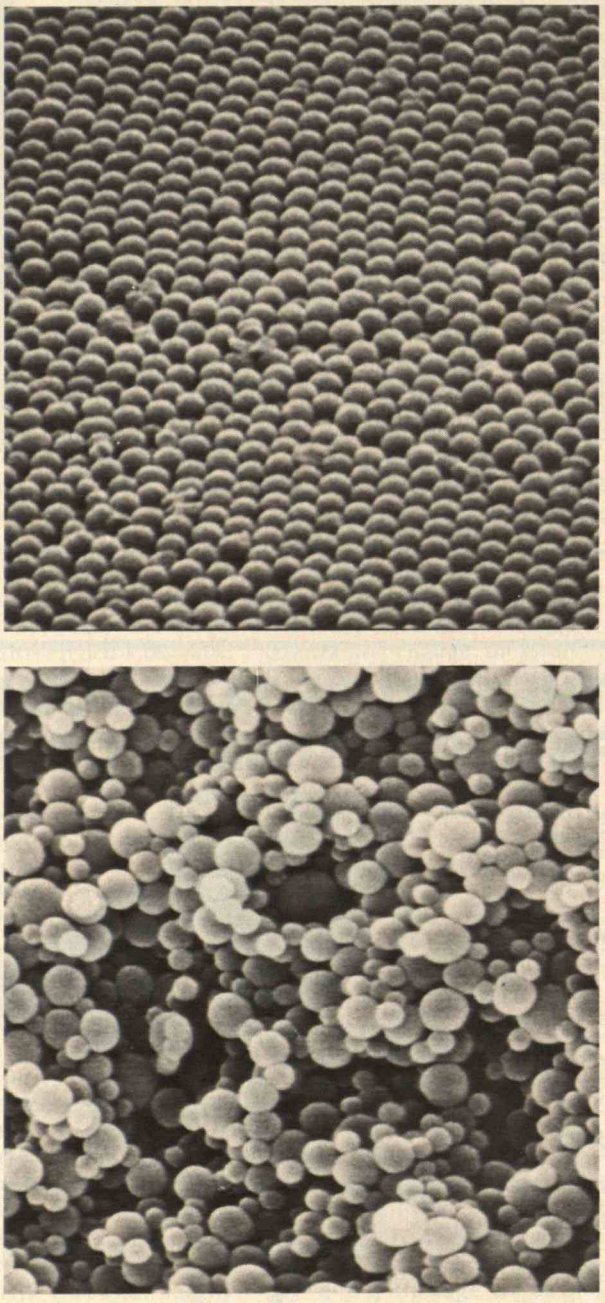
In many engines and other energy-related technologies, higher efficiency requires higher combustion temperatures. Metals, even in high-temperature alloys, can't take the heat. And most ceramics now on the market can't take the stress.

But U.S. researchers are now producing ceramic materials that can withstand high temperatures and harsh environments without cracking. Their potential is enormous. These stronger ceramics are already being used to line the combustion chambers of experimental car engines so they can burn hotter and use less fuel. The new ceramics may also enable electricity-generating systems to operate at higher and more efficient temperatures.

Ceramics manufactured by conventional processes are still being used in a wide range of products, from tiles for the space shuttle to components for computers. But expense and unreliability are major problems.

For example, ceramic pieces often shrink irregularly during conventional production. Before being sold, they must be machined to the desired shape and size—an expensive and time-consuming process. In addition, many of the pieces produced are so defective they cannot be sold, making ceramics even more expensive. And once installed, ceramics often crack at high temperatures because of microscopic flaws.

In standard processing, small but different-sized particles of ceramic materials are ground up, packed together, and consolidated further by "sintering" at high temperatures. During sintering, particle rearrangement and other processes fill many of the empty spaces. But some voids remain, becoming incipient cracks ready to break under extreme pressures.



Any voids remaining among the particles in a ceramic piece become incipient cracks, ready to break under extreme temperatures. M.I.T. researchers minimize those voids by using ordered, uniform particles, each 0.2 micrometer in diameter (top), rather than the particles now used commercially, which range from 0.2 to 1.0 micrometers (bottom).

Recognizing the potential of ceramics, many researchers have been trying to improve the technology for producing them. Battelle Columbus Laboratories and the Army Materials and Mechanics Research Center (AMMRC) are among those looking for ways to improve "hot isostatic pressing." This technique involves applying high temperatures and pressures simultaneously to produce a desired shape while increasing the ceramics' density and thus its strength. Another popular approach is "grain-boundary engineering." Since a frequent source of weakness in ceramics is the interface between grains, researchers are looking for "densification additives" that will encourage the grains to crystallize during sintering, thereby becoming more resistant to high temperatures.

United Technologies Research Center is attempting to reinforce ceramics with embedded silicon-carbide fibers. The fibers divert the path of any crack, giving the ceramic a fracture toughness five or six times greater than that of conventional ceramics. And researchers at Ford Motor Co., Stanford University, and the University of California are improving "nondestructive evaluation" techniques that can automatically scan components to detect flaws—a step crucial to quality control in high-volume production.

Researchers in the Energy Laboratory and the Materials Processing Center at M.I.T. have taken an entirely differ-

ent approach. Their aim is "to avoid flaws in the ceramic structure before it's sintered," says H. Kent Bowen, Ford Professor of Engineering. Instead of using variably sized particles and hoping the small ones will fill the voids, the M.I.T. researchers minimize the empty space by using powders composed of tiny particles of the same size and shape packed in a regular pattern.

For some substances, researchers can produce solid particles from a liquid solution by controlling the solution's composition and temperature. But such liquid-chemistry techniques are difficult or impossible to exploit in producing particles from important compounds such as silicon nitride and silicon carbide, the prime candidates for use in diesel and turbine engines. Therefore, John S. Haggerty of the M.I.T. Energy Lab and his colleagues have developed another technique using a high-power carbon-dioxide laser. The laser heats up a reactant gas; chemical reactions occur and nuclei form and grow, creating a snowstorm of tiny particles of constant composition and size. By focusing the laser on the gas, the researchers avoid heating up the container walls and other foreign substances, achieving products of unusually high purity.

The particles are then suspended in a liquid and given a charge so they repel one another. The particles become evenly spaced, seldom agglomerating because they rarely collide. The slurry is then poured into a mold, where the particles reorder. The charge is removed, and the particles draw together because of intermolecular forces. Removing the liquid yields an orderly, packed powder.

Because the particles don't need to be reorganized, sintering can be performed more quickly and at lower temperatures than required by conventional techniques. For example, Bowen's group has been able to sinter aluminum oxide (used in machine parts and high-pressure sodium vapor lamps) at 1350°C rather than 1700°C. The presintered form has relatively little void space so shrinkage during sintering is minimal, uniform, and predictable. Most important, the ceramic structures created are stronger and more reliable than those produced now.

Used in energy systems, these new materials would allow hotter, more complete burning than is possible with metals and thus higher energy efficiency. Consider, for example, an electricity-generating system that combines a gas turbine and a steam turbine. According to Raymond Bratton, ceramics science manager at Westinghouse Research and Development Center, use of ceramic blades that allow the turbines to burn hotter could yield a 15 percent drop in fuel consumption.

With ceramic components, automotive engines could run uncooled. Absent radiator, water pump, and fan belt, the engine would weigh less and have fewer parts to fail. And compared with metals, ceramics would be more resistant to corrosive attack by impurities in "dirtier" fuels.

Engine companies are already taking advantage of such improved materials. Cummins Engine Co., working with the Army Tank and Automotive Command, has developed a five-ton truck powered by an uncooled engine with a ceramic-lined combustion chambers. Robert Katz, chief of the Ceramic Research Division of AMMRC, reports that on a 500-mile highway trip, the truck got about 9 miles per gallon—a 50 percent increase over the mileage performance of a conventional cooled diesel engine. And Kyocera Corp. of Kyoto, Japan, has built a passenger car with an uncooled diesel engine made substantially of silicon nitride. While hard data are not yet available, Kyocera representatives estimate that the car should get 30 percent higher fuel economy than its conventional counterpart.

In the long term, the existence of more durable ceramics may lead to completely new auto-engine technologies that can run on a wider variety of fuels than just oil or gas. These engines could burn such inexpensive fuels as powdered coal and cow manure.

More reliable ceramics would also greatly improve integrated-circuit designs for new computer systems and other electronic equipment. Multilayer ceramic structures would allow capacitors to be smaller, less expensive, and better able to store electric charges.

Finally, stronger ceramic materials would be capable of doing the jobs now done by high-performance alloys. Many of the strategic metals in these alloys must now be imported from politically unstable countries such as South Africa and Zimbabwe. Ceramics, on the other hand, consist mainly of aluminum, zirconium, silicon, carbon, nitrogen, and oxygen—all elements that are abundant in the earth's crust or atmosphere.—*Nancy W. Stauffer* □

Japan Moves on Ceramics

Half of the high-performance ceramics now marketed worldwide are made in Japan. Britain, the traditional leader in ceramics, has lost its advantage and so has the United States, while the Japanese are becoming "world leaders" as a result of "a bold initiative," say Professors G.B. Kenney and H. Kent Bowen of M.I.T.'s Materials Processing Center.

Why Japan's aggressive posture? High-performance ceramics that have great strength, heat resistance, hardness, and insulating properties hold the key to improving electronic systems, cutting tools, engines, furnaces, filters, and other technologies. And in contrast to such conventional heavy industries as steel, autos, and chemicals, ceramics are an ideal specialty for a resource-poor nation such as Japan because they are made mostly with common materials from the earth.

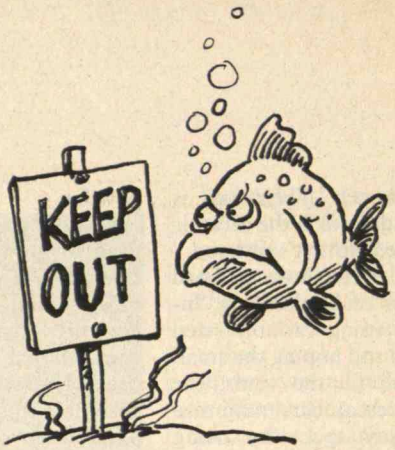
The emergence of the Japanese in this field is no accident. Ceramics was one of ten areas targeted in 1981 by the Ministry of International Trade and Industry (MITI) for intensive development as "a new generation of materials to replace metals." Toward this end, MITI has committed over $8 million for high-technology ceramics research during this decade and established a Fine Ceramics Office.

U.S. research on high-performance ceramics involves at least as much money but lacks a programmatic focus, says Bowen. U.S. re-

searchers typically concentrate on the science of new materials, including demonstration-scale tests, instead of on manufacturing—how to make these tough new products in large quantities with high uniformity for the lowest possible cost.

The Japanese seem to have a knack for focusing on such critical problems. Japan's record in making high-performance ceramics is already impressive: sales by Japanese producers were up 20 percent a year between 1978 and 1980. If that trend continues, say Kenney and Bowen, high-technology ceramics could be a $10 billion industry in Japan by 1990. And that figure doesn't take into account development of the ceramic automobile engine, with its spectacular advantages in efficiency and long life. If that promise materializes, it could add another $9 billion in ceramic sales just for Japanese-made cars.

The current initiative in high-technology ceramics will have a doubling effect, say Kenney and Bowen. It will give the Japanese profitable new products to sell in international markets, and it will improve the efficiency of Japanese industry. Thus, many Japanese products are likely to gain "an enhanced competitive position in the international marketplace."—*John Mattill* □



Ocean Research in a Storm

Starting around 1972, U.S. ocean researchers discovered that they were becoming increasingly unwelcome visitors on some other countries' seas. By 1977 the Ocean Policy Committee of the National Academy of Sciences reported that about half of U.S. research projects scheduled to take place in foreign waters were being canceled—coastal nations were denying or hindering researchers' requests.

The problem was political, according to Gary Knight, a professor of marine resources law at Louisiana State University and advisor to the U.S. Law of the Sea delegation. As Third World countries pressed for their share of ocean resources during sea-treaty negotiations and relations between them and the United States became strained, they put pressure on U.S. ocean researchers. "They know we're not going to send in the U.S. Navy for some bedraggled scientists," explains Knight.

Now that the United Nations has voted for the Law of the Sea treaty despite a negative U.S. stand, ocean researchers are still caught in this struggle. President Reagan continues to oppose the treaty, chiefly because he considers its ocean-bed-mining provisions unfair to developed nations. But though the treaty hasn't yet been ratified by enough countries to take effect, coastal nations are using it as a sort of common law, expecting their actions to be upheld by the International Court of Justice.

These nations are exerting de facto control over the continental shelf and all areas up to 200 nautical miles offshore, whichever extends further. This includes 40 percent of the oceans and nearly all areas of biological interest. Half the areas in which U.S. marine scientists have been operating are now foreign controlled.

Even if the United States were to adopt the treaty, researchers would still face troubles. As a staffer for Rep. Jack Fields (R-Tex.) complains, the treaty contains an "immense amount of ambiguity"; quoting its words does not necessarily convey its meaning. But one section would allow coastal states to censor much research done in their waters, according to Knight. Others such as David A. Ross at the Woods Hole Oceanographic Institute and John A. Knauss at the University of Rhode Island agree.

This clause ensures that if research affects coastal nations' resources—whether minerals or sea life—they can decide to prevent scientists from publishing their results, according to Knight. If the scientists publish anyway, then the treaty stipulates that the coastal country can prevent future research in its territory not only by those scientists but by all others from their country. The reasoning behind this is that the coastal countries might not have the knowledge or ability to exploit the researchers' discoveries, Knight explains: "They fear somebody at Texaco will read some obscure article and negotiate a deal to their disadvantage."

Another provision allows coastal states to cancel ongoing research almost with impunity. The sea treaty describes procedures for arbitrators to enforce settlements in many types of disputes, but no binding procedure is required if coastal states order scientists out, according to Knight. In that case, the only recourse is an ill-defined "conciliation." Ironically, the United States itself is part of the reason for this problem. U.S. delegates asked that military vessels be exempt from compulsory arbitration, so coastal countries asked that any research having to do with natural resources be exempt. The marine scientists were caught in the middle.

Since the Reagan administration is opposing the sea treaty, ocean researchers are under more political pressure than if Washington cooperated. Editorializing in *Science*, Warren S. Wooster and two other scientists from the Institute for Marine Studies at the University of Washington say that for the time being, "The State Department may be as big an impediment to U.S. ocean research as restrictions imposed by other countries."

Thus, an attitude of lukewarm acceptance of the treaty seems to have surfaced in the scientific community. Wooster and his colleagues agree that "research provisions of the treaty are tolerable if administered fairly."

ILLUSTRATION: JON MCINTOSH

David Ross from Woods Hole points out that scientists could negotiate agreements to waive undesirable treaty provisions such as postcensorship.

U.S. ratification of the treaty is a dim prospect. However, the United States can make bilateral agreements with individual countries to secure access for ocean researchers in a way that does not conflict with the sea treaty. With this in mind, Rep. Gary E. Studds (D-Mass.), who has the Woods Hole Institute in his district, introduced the "International Marine Scientific Research Act" last January.

A State Department official who is handling ocean research believes that the United States has a good chance of working out such bilateral arrangements. Concessions he considers reasonable include allowing scientists from the host nation to participate in the research, training students and funding research in that nation, and sharing data and specimens. But he complains that the Studds bill omits important provisions such as funding. Concessions would require money, he says: "Somewhere we've got to pay for our treaties."

However these matters are resolved, one result is certain in U.S. marine research, says Wooster: "The influence of political over technical considerations will increase."—*Carolyn Meinel* □

As president of the L-5 Society for Space Development, Carolyn Meinel coordinated the effort that defeated the 1979 U.N. Agreement Governing the Acts on the Moon and Other Celestial Bodies—a treaty incorporating verbatim many sections from the Law of the Sea treaty.

This braille word processor allows an operator to enter, edit, and print out text in braille. The six keys at the bottom are used to form characters; the line of readout above displays the text in raised braille dots.

Computers for the Blind

Personal computers are still thought of by many as good business tools and captivating toys but useless in daily life. How practical is it, goes the usual refrain, to file recipes electronically or print seasons' greetings on word processors? But for at least one group—the blind—personal computers are becoming vital tools in both business and everyday life.

Computerized aids to the blind are among "the most exciting products [of] the computer revolution," according to David Holladay, a computer programmer in Lewisburg, Pa. His wife, Carolyn Navy, is a blind mathematics professor at Bucknell University. (They met while undergraduates at M.I.T.)

One standard computer aid for the blind that Navy owns is the VersaBraille, a braille word processor developed by Telesensory Systems of Palo Alto, Calif. The operator enters text or mathematical formulas in braille and can check what has been entered on a "soft braille" display above the keyboard—a single line of raised-dot patterns of braille characters. After correcting and editing the text, the operator can put it into storage and get a "hard braille" copy—paper imprinted with the raised braille dots.

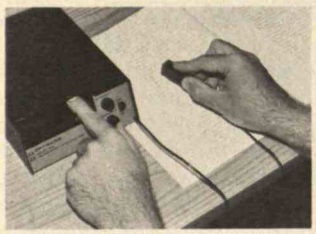
To produce a printout in ordinary type, the VersaBraille can be connected to a standard-print word processor of the kind usually found in offices. For example, suppose a lawyer writes a contract between two parties on a word processor. If one of the parties is blind, he or she can get a copy in braille, insert new clauses, and send them in print to the others.

However, such office word processors are expensive. Most blind people are forced to read their manuscripts to others to have them transcribed. After preparing information for her mathematics class on her VersaBraille, Carolyn Navy used to transcribe it herself using a conventional IBM Selectric typewriter—no mean feat. This meant keeping track of where she was in the copy and changing among three different type balls to produce superscripts and subscripts. "I wish I had a nickel for each time I heard, 'David, which line am I on now?' " recalls Holladay.

He decided it was a job for a computer and wrote a program that he calls Braille Edit to connect the VersaBraille to his relatively inexpensive Apple II personal computer. Now Navy can use the Apple II to make printouts of tests,

PHOTOS: JIM SNYDER

This device scans ordinary print and reproduces the letters in a raised pattern. A blind person is thus able to read any text.



class handouts, and other documents in standard characters.

The blind are also turning to voice-synthesis programs on personal computers to read documents. These programs produce electrical signals representing phonetic sounds, which can then be played through speakers. The programs can use any document that has been entered into a computer from a storage disc or telephone lines. This includes text from information "utilities" such as The Source that provide access to news, indexes, electronic mail, and other services. (*See "Personal Computers: Passport to the Electronic Universe," May/June, page 62.*)

Perhaps the most sophisticated reading machine, made by the Kurzweil Co., scans ordinary printed pages and reads them aloud. A user can, for example, insert a copy of *Moby Dick* from the library and the machine will read it at any designated speed. The machine's performance may not be up to the standards of a seasoned actor, but it can go back and repeat sections or spell words.

The problem with most of these technological aids is cost. A Kurzweil machine costs $30,000, and almost all of the 325 in use today are in libraries. "A blind person has to read on other people's schedules," says Roger Cicchese, president of Access to Life, a Somerville, Mass., nonprofit organization that does consulting work relating to the handicapped. Even the less sophisticated technology is not cheap—a VersaBraille plus an Apple II for a home system costs about $10,000.

"The difficulty is circular," says Shane Snowden of Kurzweil's marketing department. "There are a lot of blind people in the United States, but because of discrimination, they are poorer than the general population" and thus have less money to spend on expensive hardware. Kurzweil must actively seek government and other nonprofit purchasers. Cicchese, who is blind, puts the matter another way: "This equipment is available only to the very well off or those who are savvy enough to badger agencies or employers into purchasing it for them."

Advanced telecommunications could make some services cheaper. An expensive reading machine in a library could, for example, scan *Moby Dick* and send it over the phone lines to a blind person's VersaBraille. Many books could be transmitted this way for the price of a single reading machine. Unfortunately, the Kurzweil machine requires a human to turn the book's pages, so this is not yet practical.

For the blind person who does not have a VersaBraille word processor, the National Braille Press in Boston is considering establishing a service to translate videotext or any other documents that can be sent electronically into hard-copy braille printouts. An individual could receive these by mail and would be charged for them. "I see a number of relationships between institutions owning high-priced equipment and blind users in the home," says Cicchese.—*Jon Zonderman* □

Peasants and Technology

Mechanized farming in developing countries often falls short of expectations. Machinery, chemicals, and fuel are expensive; mechanics are scarce. There's often no easy way to bring farm products to market. And worst of all, some critics say, mechanization encourages farmers to till large tracts of land, and in the process of consolidation, peasants may be displaced.

Is there a middle ground? The Nicaraguan government's Appropriate Technology Research Center (CITA) is looking for one. Seeking techniques that peasants can comprehend and afford, CITA is introducing scaled-down mechanized tools and improving traditional ones.

One example concerns how to better harvest and store corn. Traditionally, peasants have left their corn standing in the field to dry. They then dump it in corn cribs—large wooden boxes resting on the ground—until time to sell or use it. Unfortunately, 30 to 40 percent of the crop is lost, says Peter Marchetti, an American Jesuit working for the Nicaraguan Ministry of Agriculture. Birds and insects nibble at the corn in the fields; rodents and rot attack it in the cribs.

Now CITA has developed a new corn crib to cut such losses. To prevent rodents from climbing into it, the crib stands on wooden legs wrapped with metal. The crib's sides are made of lattice so the corn dries without rotting. In addition, the center recommends dusting the crib with a 4 percent Malathion powder to kill rats. This raises obvious questions of safety, but CITA researcher Leonardo Barreto insists that the amount of Malathion is too small to affect people who eat the corn. It remains to be seen whether peasants—who after all are not deluged with reports of hazardous substances on the evening news—will misuse the chemical.

Because the corn can be dried in the new cribs and need no longer stand in the fields after it is ripe, the land is freed earlier in the year. This allows enough time for an entire additional crop, according to Barreto. Francisco Campbell, first secretary of the Nicaraguan Embassy in Washington, says that in the short run this extra crop is important for economic development. But he agrees that in the long run the land might not be able to support an extra crop. In response to this problem, Danilo Saravia, head of CITA, is beginning a program to analyze both the nutrients needed by soils and the fertilizers that could be produced by recycling vegetable refuse in "digesters"—upgraded compost piles.

Like CITA's other agricultural technologies, the corn cribs have been tested but are not yet in widespread use. Five hundred peasants trained by the Ministry of Agriculture are now back in their villages training others to make and use the cribs.

Saravia says that peasants will benefit from using the cribs because the government food corporation, ENABAS, is paying more for crops to increase the food supply. And the government is improving roads from rural areas to towns and cities where peasants can sell their harvest.

CITA is also modifying mechanized farming tools to make them appropriate for

The traditional peasant's plow (large photo) is little more than a stick. A set of modern discs (left inset), adapted to be towed by oxen rather than a tractor, was developed by the Appropriate Technology Research Center of the Nicaraguan government. A gang plow for cultivating between rows of young corn (right inset) was also developed.

peasant farmers. For example, a new wooden plow has a light metal moldboard to dig deeper and turn the soil better than the traditional pointed pole, yet it can still be pulled by an ox—the only form of power available to farmers. A set of discs and a cultivator are also designed to be towed by oxen. The construction is simple, so peasants can repair most of the problems that might occur.

It may seem ironic that Nicaragua is adopting the moldboard plow just when some American farmers are adopting "no-till" farming, which dispenses with plows to help conserve the soil. However, no-till methods generally rely on sophisticated pesticides that kill weeds and then rapidly degrade. Nicaragua wishes to avoid the need for such expensive imports.

A more original development is a squat cement "silo," as Saravia calls it in English—a small silo-shaped structure for storing grain that can be constructed by farmers' cooperatives. Because the silo stores only about 25 tons, it needs no exhaust system to keep down concentrations of grain dust, which might explode in a larger container. Rice husks mixed into the concrete make the silo less permeable to humidity and oxygen, which deteriorate grain.

Oddly enough, the large mechanized farms in Nicaragua—some of them state-owned but more owned by relatively wealthy landowners—still receive 85 percent of the government's agricultural aid. These farms are important because they produce export crops such as cotton that bring in foreign currency, which is needed to pay back the national debt and buy needed equipment from abroad.

The small- and medium-sized peasant farms, responsible for 70 percent of the country's food production, receive 15 percent of total agricultural aid. This may not seem like much, but in 1976 under the Somoza regime, less than 1 percent of government agricultural aid went to farmers producing crops to be consumed in the country, according to the Nicaraguan National Development Bank.

The present government hopes that by aiding peasant farmers it will reduce the need to import food—and thus the amount of currency required to pay for it. Saravia believes CITA's work will generate more employment in the countryside, helping to halt the current heavy migration to the cities and stimulating the economy.—*Peter Downs* □

Peter Downs, a writer who frequently covers agriculture, recently returned from Nicaragua.

PHOTOS: LEONARDO BARRETO

But Is It Art?

Once considered vulgar symbols of a consumer society, giant neon signs are fast becoming icons of a bygone automotive era. From the neon glitter of Las Vegas to New York boutiques that specialize in neon art, the once-maligned advertising medium has become respectable. The very preservationists who formerly decried its impact now often defend it.

That ironic realignment is taking place in Boston, where preservationists, city planning officials, and citizens have been debating whether to give historic-landmark status to a massive neon Citgo sign. Erected above Kenmore Square in 1965 as part of a nationwide advertising campaign, the 3,600-square-foot sign featured the company's then-new corporate motif—a red triangle over a blue-lettered Citgo name, all superimposed on a white background. The sign's 5,878 neon-filled glass tubes pulsed in one of the country's first computer-generated light displays.

The sign quickly became a Boston landmark. The dazzling light show was surprisingly beautiful, especially when reflected in the nearby Charles River. Drivers and pedestrians used the sign to orient themselves on the area's winding streets. "Much to everyone's surprise," says Arthur Krim, former president of the Society for Commercial Archaeology, "the sign became an integral part of the Boston skyline."

Those who have lived nearby talk, sometimes rapturously, about the sign. "I remember one of the first times I went downtown after I came to school here," says Mark Jurkowitz, a Boston University student in the early 1970s. "We took a cab back to BU and it seemed like the driver was taking a long way. We were really paranoid. But when we saw the Citgo sign, we knew we were home."

"We used to go down to the Charles at night and watch the sign," adds Preston Gralla, who came to the area in the mid-1970s. "You had to have seen it. It was hypnotic."

Such sentiments were not isolated. A 1971 study of Boston's signs and lights by the Boston Redevelopment Authority showed the Citgo sign was the only commercial sign that the public thought should remain.

But times changed. Rising energy costs, Citgo's decision to abandon neon as an advertising medium, and increased maintenance costs led Cities Service officials to turn it off in 1979. In 1982, when the oil company's rooftop lease expired, the firm moved to dismantle the sign. "A 1952 Buick is also a good example of automotive culture," says W. James McCarthy, a Cities Service attorney. "But would you want to be forced to maintain it forever?"

Many opposed the decision to dismantle. "When you consider that the sign represents a former exuberance, that it is one of the finest examples of corporate neon art in America, and that it orients people in a city that is notoriously confusing—then you must see it is really worth saving," says Krim.

Even a recent study by the Boston Landmarks Commission on whether to make the sign a protected landmark managed to rise above standard bureaucratic prose: "While [the sign's] use of neon and the sizable amount of neon tubing are not unusual, the use of a computer, allegedly the first, to direct the sign's lightshow, and the hard-edged, simple, bold graphics in both daytime and nighttime versions, provide a unique exterior and highly public example of Pop Art that prevailed in the 1960s."

Company officials were surprised to find that they had an object of historic significance on their hands. "It is difficult for Cities Service to comprehend the fact that some people consider the Citgo sign on a par with the Old North Church or the USS Constitution," says McCarthy. He adds that preserving the sign is not without its

PHOTO: CITIES SERVICE CO.

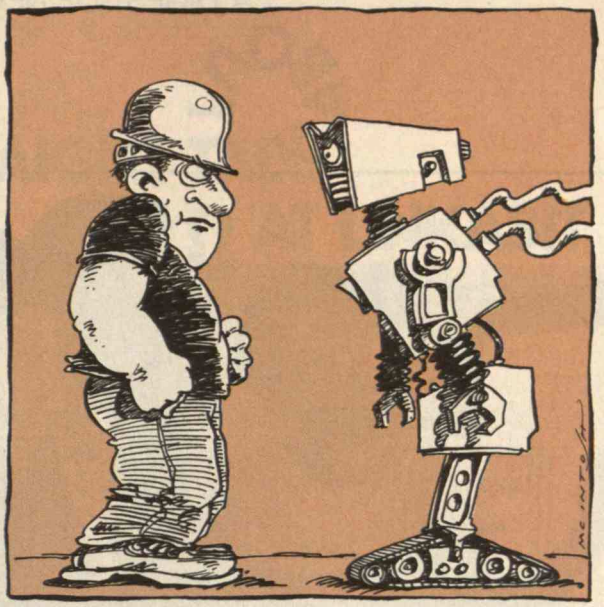
problems. If Citgo, which was recently acquired by Occidental Petroleum, ceases to exist as an independent entity, or if it abandons its current advertising logo, the neon sign would either become obsolete or advertise a product that doesn't exist.

In the end the Boston Landmarks Commission turned down a request to designate the sign a landmark. Approving such a request for a piece of neon advertising would have raised a host of legal and economic questions: How would landmark status for the sign affect the owners of the building that it is mounted on? Can a company be required to preserve something that was only designed to last 20 years? But the commission did agree with preservationists that the sign has artistic significance.

As a result of the debate over the aging sign, Cities Service officials agreed to renovate it and operate it for at least three years. "Remember this is an advertising medium," says McCarthy, "and the importance of an advertising medium is how the public relates to it."

Robert Campbell, architecture critic for the *Boston Globe* and himself something of a buff on the Citgo sign, views the rescue effort more philosophically. "What interests me is the fact that the beautiful past used to end sometime around 1850," he says. "Twenty years ago the Society for the Preservation of New England Antiquities wouldn't consider saving anything that came after the Civil War. Then there was a movement to save Victorian houses and later to save Art Deco. Now we're at a point where we're trying to save the few remaining pieces of neon highway culture."—*David Luberoff* □

Too High on High Tech?



High technology is widely held to be the key to future U.S. prosperity. But that idea is simplistic, says Professor Bennett Harrison of M.I.T. In fact, high technology is and will remain a modest source of employment—and perhaps a source of unemployment. And the success of high technology depends upon the success of almost every other sector in the economy. Because of "high-tech myopia," Harrison says, "whole segments of the private sector are getting very short shrift."

Harrison's figures show that high-technology industries are highly automated, at best a modest factor in the U.S. labor market except among a few groups of professionals. For example, in Massachusetts high technology employs no more than one in eight workers, according to Harrison. And M.I.T. Professor David L. Birch says high-technology employment in the state is dropping while other segments—such as banking and finance—are growing. In California, the high-technology industry is responsible for only 7 percent of the state's jobs.

Even in 1990, the United States will need fewer than 1 million computer-system operators, analysts, and maintainers, compared with 3.3 million sales clerks and 3.25 million janitors, according to Max L. Carey of the Bureau of Labor Statistics. And if robots succeed in displacing workers in basic industry, high technology's weak positive effect on employment could change to a strong negative one.

Reason enough for Howard D. Samuel, president of the Industrial Union Department at the AFL-CIO, to warn that "those who urge us to concentrate on expanding high technology as a solution to our employment problems in manufacturing are barking up the wrong tree."

Harrison is especially concerned that high technology tends to offer limited opportunities to skilled workers in the middle range of wages—effective workers who, he says, are the foundation of long-term labor productivity. Instead, high technology is used in automated machinery that makes possible the hiring of unskilled and part-time labor, he says.

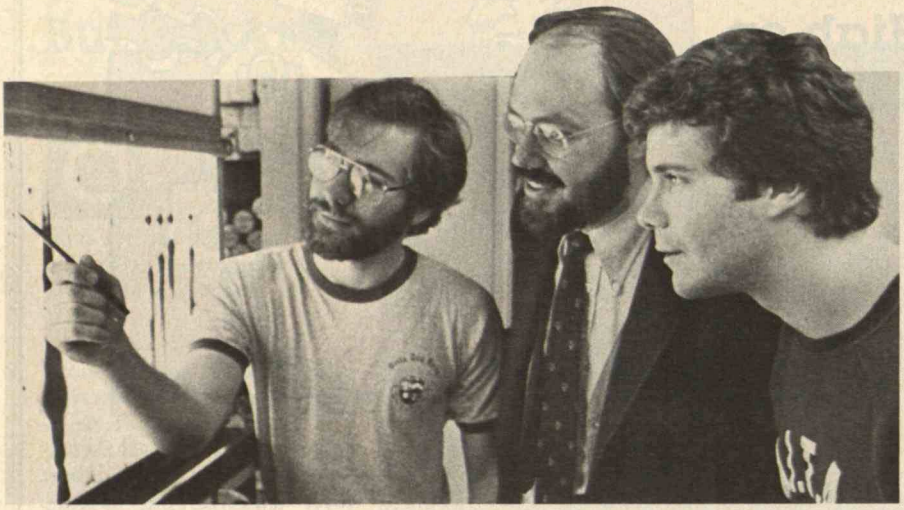
The same phenomenon occurred in New England in the 1920s, when companies in the mature textile and shoe industries gave most of their pay checks to an unskilled labor force. When mills left in the 1950s to exploit lower-cost environments, the region had no reserve of skilled labor on which to base its reconstruction.

Today only 3 percent of those who once worked in the mill industries—including even the youngest group—are now in high technology, according to Harrison. The rest have taken jobs in the low-paying services sector, migrated out of Massachusetts, or dropped out of the labor force entirely. And Massachusetts wage rates have never recovered. Even now Boston ranks as "one of the lowest-paying regions for computer-related workers," Harrison says.

The growth of the high-technology industry is often considered an end in itself, says the AFL-CIO's Samuel. But its future depends on the health of the sectors that use its products, such as the automobile industry, which buys robots and dashboard computers. Harrison fears that the attention now being given to high technology by the media and government has crowded out the voices of too many other "less exciting" industries. That's especially serious, he thinks, because conventional industries' needs—such as more consistent regulation of chemicals and better labor relations in heavy industry—are different from the needs of high technology, which include more venture capital and better education.

It's not that anyone wants high technology to step down—"we can't do without it," Harrison asserts. It's just that high technology should step aside a little so that others' voices can also be heard.—*John Mattill* □

ILLUSTRATION: JON MCINTOSH



Collaboration in frontier research is a major mode for undergraduate education at M.I.T.—and it happens even in such high-technology fields as molecular cloning and gene splicing. The photograph shows Professor Philip Sharp, associate director of the Center for Cancer Research, with Jonathan Goldstein (left) and James Ellard. They're studying an oncogene problem "that made headlines only months ago," Dr. Sharp explains. There's a long waiting list of students who want to register for the Project Laboratory Program, and undergraduates have priority.

Making Us Innovative

To stimulate its technological innovation and productivity, says Howard W. Johnson, chairman of the M.I.T. Corporation, the United States must take some risks like those it is learning to take in the environmental field.

Even before we understand "the full calculus of risk and benefit," we invoke regulations in the name of health protection. And we must do the same thing to stimulate innovation, Mr. Johnson said in the John G. Palfrey Memorial Lecture at Columbia University Law School early in the spring. We must provide special conditions and incentives for inventions and new technology-based products even before we are sure of their costs and benefits.

Such experimentation is implied in the national industrial policy advocated by the National Academy of Sciences' Panel on Advanced Technology Competition and Industrialized Allies, of which Mr. Johnson has been chairman during the last two years. In its report released just after Mr. Johnson's Palfrey Lecture, the panel urged:

☐Free trade in advanced-technology products and services. If "key technology . . . industries are considered endangered by the actions of another country," said the panel, "the U.S. should negotiate with the other country requesting immediate relief. Unilateral actions . . . [should be] a step of last resort."

☐Specific government actions to create an environment encouraging innovation, including new tax policies, patent laws, antitrust exclusions, deregulation, procurement policies, and export/import bank loans. There should be flexibility and experiment so that policies can be altered as necessary to stimulate innovation.

U.S. innovative capacity is "flawed by a national misconception of its needs," John E. Steiner, vice-president of the Boeing Co. told the Senate Finance Committee during the panel's review of its report. There is a deep chasm in the national understanding of technology, he said, and it is to this problem that the proposed review is directed. ☐

Progress on Controlled Release

Successful animal tests of advances in the controlled delivery of drugs were reported this spring to the American Chemical Society by students and former students of Professor Robert S. Langer of the Department of Nutrition and Food Science.

☐Stainless-steel beads in an implanted plastic carrier containing medication can provide controlled release: an alternating magnetic field vibrates the beads, and their movement forces medication from the container.

☐A biodegradable polymer vial containing medication degrades after implantation, gradually releasing the medication and making surgical removal of the vial unnecessary.

The magnetic delivery system was reported by Elazer Edelman, a fourth-year medical student in the Harvard-M.I.T. Health Sciences and Technology Program. The biodegradable carrier was described by Dr. Robert J. Linhardt of the University of Iowa, formerly a postdoctoral research associate in Dr. Langer's M.I.T. Laboratory. ☐

Saving Energy in Buildings

Improved energy efficiency for buildings is the goal of a new $1.5 million-a-year program shared between the M.I.T. Energy Laboratory and the School of Architecture and Planning. It's a major effort "to develop more energy-efficient technologies and designs for buildings of all types and for their energy systems," says Leon Glicksman, program director.

One new feature: major use of scale models to study the energy efficiency of buildings and their components. The fact that walls, slabs, foundations, and many other components of completed structures are inaccessible is "a major barrier" in efficiency studies, says Glicksman, so he wants to use scale models to provide data otherwise unavailable. ☐

"OPEC . . . Prices Could Explode"

"Is OPEC dead?" asked sophomore Daniel Crean of M.I.T.'s student newspaper *The Tech*.

"A mighty vigorous corpse if it is," answered Morris A. Adelman, an oil-market expert who is also professor of economics at M.I.T. "Anyone who can collect $29 a barrel for a product they can produce for $5 or $10, sometimes for less than 25 cents, is very much alive."

"What's ahead for OPEC?" asked Crean.

"The most likely prospect is for fluctuations. The scheme holds for a while and

then they cheat, and they fall out amongst themselves, and the price drops, and that brings them together again."

"What about gas and oil prices—up or down?" asked Crean.

"I don't see them dropping much more," replied Adelman. "If you have a reasonable revival in the world economy, the demand for oil will increase. And if OPEC countries stick to the quotas that they've set for themselves, then the price could explode again the way it did four years ago. I don't think this could happen before the summer, maybe not before the fall, but it definitely could . . ." □

When Taxes Go Down

To cities and schools hard-pressed by tax caps and the recession, Professor Lawrence E. Susskind of the Department of Urban Studies and Planning has four suggestions for raising money that don't depend on increasing taxes:

□ Levy fees and user charges to support services such as sewers, water, and after-school sports.

□ Let the schools make more use of the community as an educational resource. What does that mean? Adopt a weekly schedule with four days of school and a fifth day of apprenticeships with local businesses or institutions, for example.

□ Generate new income from existing facilities and workers. For example, let teachers use that fifth day to give classes for tuition-paying adults. And let schools lease facilities—such as gymnasiums and swimming pools—when students don't need them.

□ Let the schools go into fund raising, collecting tax-deductible contributions for purposes not covered by regular budgets.

Professor Susskind is director of an M.I.T. project assessing the effects of Massachusetts' Proposition 2½ "tax-cap" legislation of 1978 on the state's cities. In general, he says, Massachusetts communities fared better than pessimistic observers had expected during the first year after Proposition 2½ was passed: none was forced to make "devastating" budget cuts. But there have been serious problems for larger cities. "The combined effects of layoffs, attrition, increased user chargers, deferred capital improvement, and revaluation have begun to take their toll," he says. And children have been the biggest losers of all: schools have borne "a disproportionate share of total cuts." □

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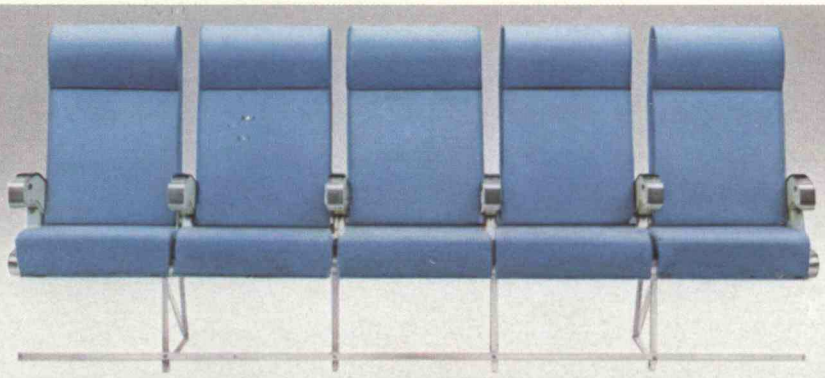

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